



This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

### Usage guidelines

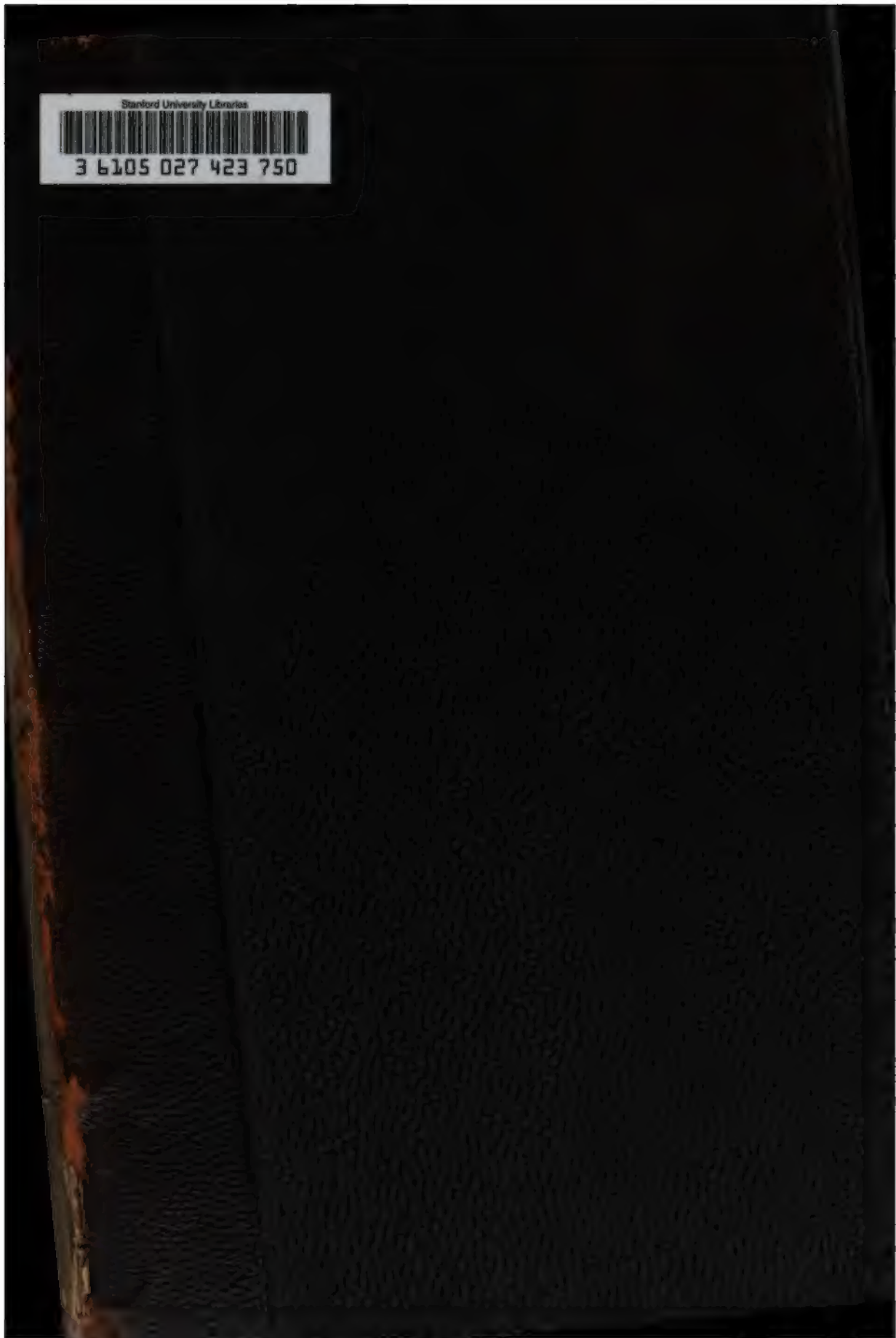
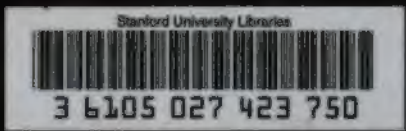
Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

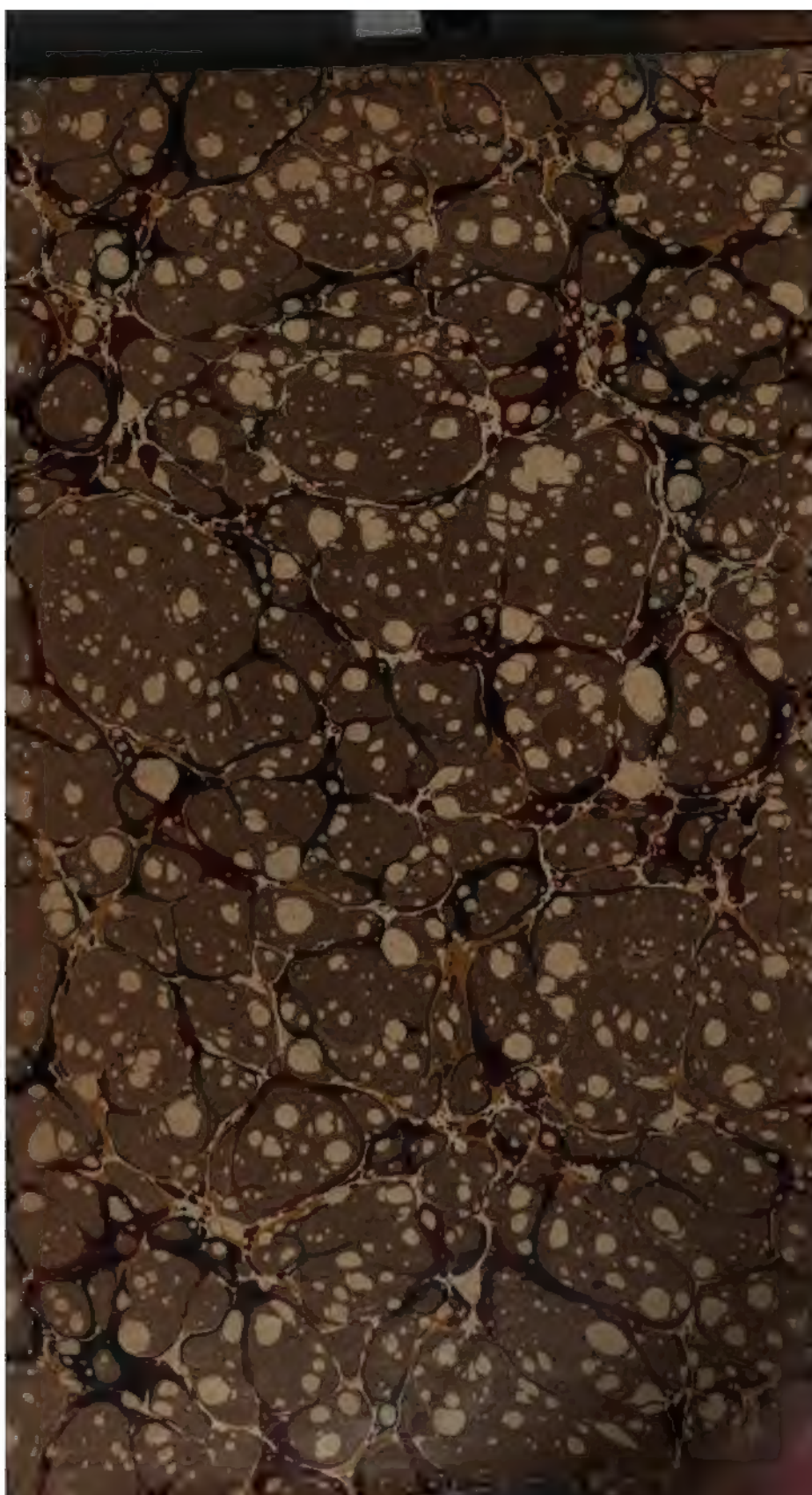
We also ask that you:

- + *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.
- + *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.
- + *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.
- + *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

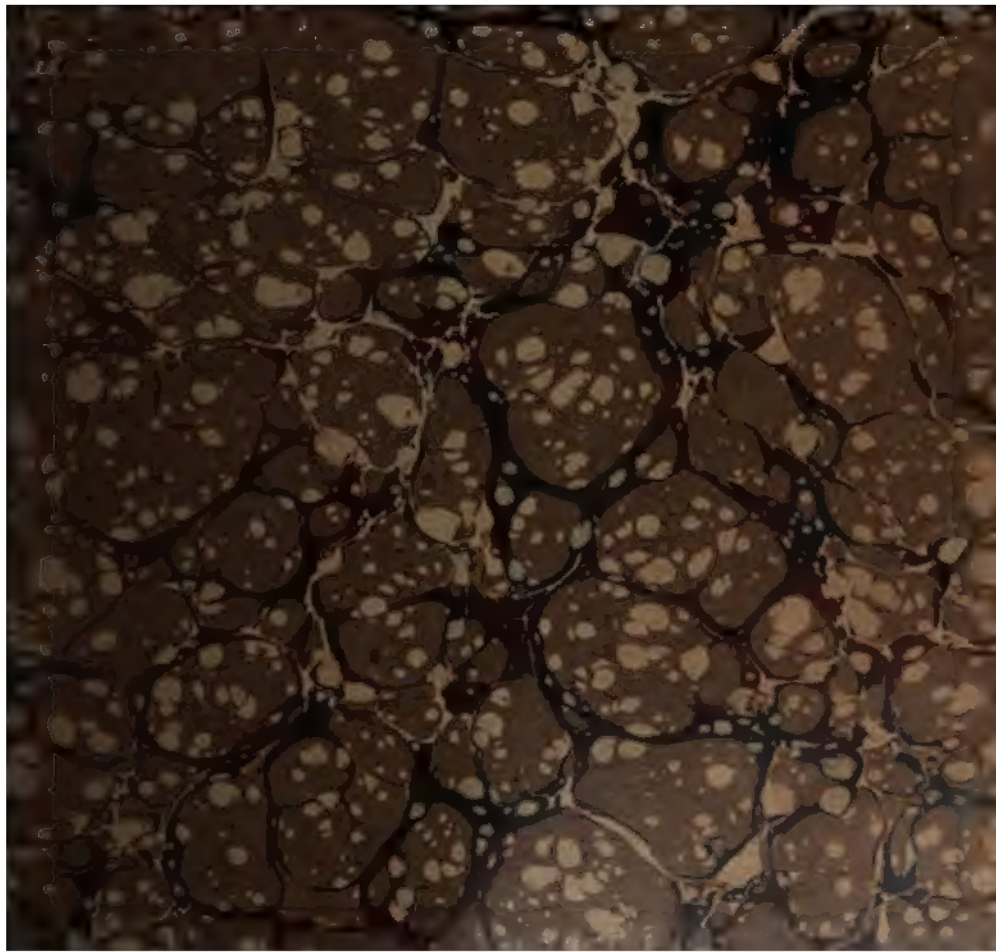
### About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at <http://books.google.com/>







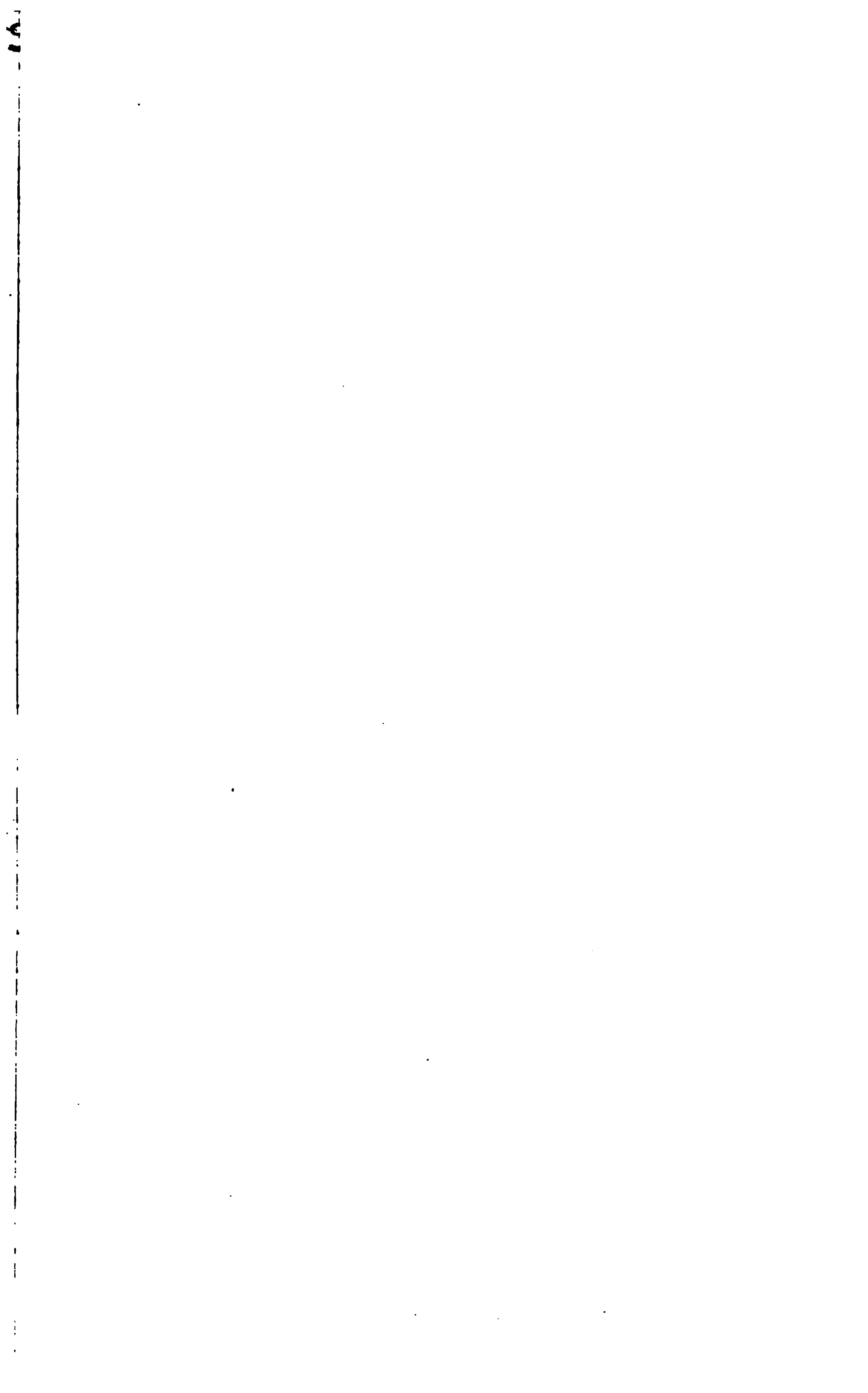




vb

bb4m











4721-31679

—1174—

SMITHSONIAN  
**MISCELLANEOUS COLLECTIONS**

VOL. XLI



"EVERY MAN IS A VALUABLE MEMBER OF SOCIETY WHO BY HIS OBSERVATIONS, RESEARCHES,  
AND EXPERIMENTS PROCURES KNOWLEDGE FOR MEN.—SMITHSON."

STANFORD LIBRARY

CITY OF WASHINGTON  
PUBLISHED BY THE SMITHSONIAN INSTITUTION  
1902



146673

УВАЖАЮЩИЙ ОБОЗНАЧЕНИЕ

#### ADVERTISEMENT.

---

The present series, entitled "Smithsonian Miscellaneous Collections," is intended to embrace all the publications issued directly by the Smithsonian Institution in octavo form; those in quarto constituting the "Smithsonian Contributions to Knowledge." The quarto series includes memoirs, embracing the records of extended original investigations and researches, resulting in what are believed to be new truths, and constituting positive additions to the sum of human knowledge. The octavo series is designed to contain reports on the present state of our knowledge of particular branches of science; instructions for collecting and digesting facts and materials for research; lists and synopses of species of the organic and inorganic world; museum catalogues; reports of explorations; aids to bibliographical investigations, etc., generally prepared at the express request of the Institution, and at its expense.

In the Smithsonian Contributions to Knowledge, as well as in the present series, each article is separately paged and indexed, and the actual date of its publication is that given on its special title-page, and not that of the volume in which it is placed. In many cases works have been published and largely distributed, years before their combination into volumes.

S. P. LANGLEY,

*Secretary S. I.*

YSA 981 0907NA12



## TABLE OF CONTENTS.

---

- ARTICLE I. (1171.) INDEX TO THE LITERATURE OF THALLIUM,  
1861-1896. BY MARTHA DOAN. 1899. Pp. 26.
- ARTICLE II. (1173.) INDEX TO THE LITERATURE OF ZIRCONIUM.  
BY A. C. LANGMUIR AND CHARLES BASKERVILLE. 1899. Pp. 29.
- ARTICLE III. (1253.) A SELECT BIBLIOGRAPHY OF CHEMISTRY,  
1492-1897. BY H. C. BOLTON. SECTION VIII.  
ACADEMIC DISSERTATIONS. 1901. Pp. iv, 534.
- ARTICLE IV. (1258.) ON THE CHEAPEST FORM OF LIGHT. BY  
S. P. LANGLEY AND F. W. VERY. 1901. Pp.  
20. Plates I-III.
- ARTICLE V. (1259.) LIST OF OBSERVATORIES. 1902. Pp. 48.
- ARTICLE VI. (1312.) INDEX TO THE LITERATURE OF THE SPECTROSCOPE,  
1887-1900. BY ALFRED TUCKERMAN. 1902. Pp. iii, 373.
- ARTICLE VII. (1313.) A BIBLIOGRAPHY OF THE ANALYTICAL  
CHEMISTRY OF MANGANESE, 1785-1900. BY  
HENRY P. TALBOT AND JOHN W. BROWN.  
1902. Pp. viii, 124.
- ARTICLE VIII. (1314.) CHEMICAL SOCIETIES OF THE NINETEENTH  
CENTURY. BY H. C. BOLTON. 1902. Pp. ii, 15.



SMITHSONIAN MISCELLANEOUS COLLECTIONS.

— 1171 —

INDEX TO THE LITERATURE  
OF  
THALLIUM,  
1861-1896.

BY  
MARTHA DOAN.



WASHINGTON CITY:  
PUBLISHED BY THE SMITHSONIAN INSTITUTION.  
1899.



**The Knickerbocker Press, New York**

## LETTER OF TRANSMITTAL.

WASHINGTON, July 6th, 1898.

The Committee on Indexing Chemical Literature, appointed in 1882 by the American Association for the Advancement of Science, has voted to recommend to the Smithsonian Institution for publication the following:—

INDEX TO THE LITERATURE OF THALLIUM, 1861–1896,  
by Miss Martha Doan.

H. CARRINGTON BOLTON, *Chairman.*

MR. S. P. LANGLEY,  
*Secretary of the Smithsonian Institution.*



## INDEX TO THE LITERATURE OF THALLIUM.

1861-1896.

BY MARTHA DOAN.

- 1861 : 1. W. CROOKES. (Discovery.)  
Chem. News, 3, 193, 303; Am. J. Sci. [2], 32, 411; Phil. Mag. [4], 21, 301; Bull. Soc. chim., 3, 211, 289; Chem. Centrbl., 1861, 496; N. Arch. ph. nat., 11, 160; Jsb., 1861, 44, 130.
- 1862 : 1. A. LAMY. (Discovery, occurrence, and extraction—Properties and compounds.)  
Ann. chim. phys. [3], 67, 385, 418; Am. J. Sci. [2], 35, 273; Compt. rend., 54, 1255; 55, 836; J. pharm. [3], 42, 81; Ann. der. Phys. Pogg., 116, 495; Ann. Chem. Liebig, 124, 215; Bull. Soc. chim., 4, 291; 5, 81; Instit., 1862, 416; Phil. Mag. [4], 24, 185; N. Arch. ph. nat., 14, 400; 16, 77; Dingl. pol. J., 165, 284; Z. Chem. Phar., 1862, 428; J. prakt. Chem., 86, 250; 88, 173, 362; Chem. News, 6, 29; Chem. Centrbl., 1862, 625; Zeit. Chem. Phar., 1863, 125; Jsb., 1862, 176.
- 1862 : 2. W. CROOKES.  
Proc. Roy. Soc., 12, 150; Chem. News, 6, 1; Am. J. Sci. [2], 34, 275, 409; Pharm. J. Trans. [2], 4, 63; Ann. Chem. Liebig, 124, 203; J. prakt. Chem., 88, 167; Chem. Centrbl., 1862, 808; Vierteljschr. Pharm., 12, 60; Bull. Soc. chim., 4, 404; Jsb., 1862.
- 1862 : 3. REGNAULT. (Specific heat.)  
Comptes. rend., 55, 887; Instit., 1862, 418; Ann. chim. phys. [3], 67, 427; Ann. Chem. Liebig, 126, 83; Zeit. Chem. Phar., 1863, 94; Bull. Soc. chim., 5, 81; Jsb., 1862, 180.
- 1862 : 4. F. KUHLMANN. (Organic salts and estimation of Tl.)  
Compt. rend., 55, 607; Instit., 1862, 348; Ann. chim. phys. [3], 68, 341; Ann. Chem. Liebig, 126, 75; J. prakt. Chem., 88, 175; Zeitschr. Chem. Phar., 1862, 690; Chem. Centrbl., 1863, 70; Bull. Soc. chim., 4, 408; Jsb., 1862, 187.
- 1862 : 5. DE LA PROVOSTAYE. (Crystalline form of some organic salts.)  
Compt. rend., 55, 610; Ann. Chem. Liebig, 126, 79; J. prakt. Chem., 88, 178; Zeitschr. Chem. Phar., 1862, 693; Jsb., 1862, 187.

- 1863 : 1. W. A. MILLER. (Spectrum.)  
Lond. R. Soc. Proc., 12, 407 ; Phil. Mag. [4], 26, 228 ; Chem. News, 7, 146 ; N. Arch. ph. nat., 18, 359 ; Ann. chim. phys. [3], 69, 507 ; J. prakt. Chem., 91, 190 ; Chem. Centrbl., 1864, 246 ; Jsb., 1863, 112.
- 1863 : 2. R. BÖTTGER. (Occurrence in salt waters.)  
Frank. phys. Ver., 1863, 1 ; Ann. Chem. Liebig, 128, 240, 368 ; J. prakt. Chem., 89, 378 ; 90, 145 ; Chem. Centrbl., 1863, 669 ; Jsb., 1863, 185.
- 1863 : 3. F. KUHLMANN. (Lead-chamber deposits.)  
Compt. rend., 56, 171 ; Instit., 1863, 26 ; Ann. chim. phys. [3], 67, 428 ; Bull. Soc. chim., 5, 122 ; J. prakt. Chem., 88, 433 ; Dingl. pol. J., 167, 455 ; Jsb., 1863, 246.
- 1863 : 4. A. LAMY. (Toxicological effects of Tl.)  
Compt. rend., 57, 442 ; Instit., 1863, 265 ; J. Pharm. [3], 44, 285 ; Chem. Centrbl., 1864, 287 ; J. prakt. Chem., 91, 366 ; Jsb., 1863, 255.
- 1863 : 5. W. T. ROEPPEL. (Occurrence in furnace products.)  
Am. J. Sci. [2], 35, 420 ; Jsb., 1863, 246.
- 1863 : 6. HEREPATH. (Occurrence in Bi.)  
Trans. Pharm. J., 4, 302 ; Jsb., 1863, 236, 243, 687.
- 1863 : 7. L. DE LA RIVE. (Specific gravity and electrical conductivity.)  
Compt. rend., 56, 588 ; Instit., 1863, 93 ; N. Arch. ph. nat., 17, 67 ; Bull. Soc. chim., 6, 270 ; Ann. Chem. Liebig, 128, 128 ; Phil. Mag. [4], 26, 236 ; J. prakt. Chem., 91, 369 ; Chem. Centrbl., 1864, 404 ; Jsb., 1863, 249.
- 1863 : 8. MATTHIESSEN and VOGT. (Electrical conductivity.)  
Ann. der Phys. Pogg., 118, 431 ; Phil. Mag. [4], 26, 542 ; Ann. Chem. Liebig, 128, 128 ; Bull. Soc. chim., 6, 270 ; Lond. R. Soc. Proc., 12, 472 ; Jsb., 1863, 249.
- 1863 : 9. GASSIOT. (Spectrum.)  
Lond. R. Soc. Proc., 12, 536 ; Phil. Mag. [4], 27, 143 ; Chem. Centrbl., 1864, 404 ; Jsb., 1863, 112.
- 1863 : 10. CROOKES. (Preparation of Tl. in large amounts.)  
Chem. News, 8, 159 ; Rep. chim. app., 5, 435 ; J. pharm. [3], 45, 216 ; Chem. Centrbl., 1864, 401 ; Jsb., 1863, 246, 248.
- 1863 : 11. CROOKES. (Priority of discovery.)  
Phil. Mag. [4], 26, 55 ; J. prakt. Chem., 90, 19.
- 1863 : 12. W. A. MILLER. (Spectrum of Thallium.)  
Lond. R. Soc. Proc., 12, 407 ; Phil. Mag. [4], 26, 228 ; Chem. News, 7, 146 ; N. Arch. ph. nat., 18, 359 ; Ann. chim. phys. [3], 69, 507 ; J. prakt. Chem., 91, 190 ; Chem. Centrbl., 1864, 246 ; Jsb., 1863, 112.

- 1863 : 13. R. BÖTTGER. (Occurrence in salt water at Nauheim and —.)  
Ann. Chem. Liebig, 127, 240, 368 ; Jour. prakt. Chem., 89, 378 ; 90, 145 ; Chem. Centrbl., 1863, 669 ; Jsb., 1863, 185.
- 1863 : 14. ERDMANN.  
J. prakt. Chem., 89, 391 ; Chem. Centrbl., 1864, 403 ; Jsb., 1863, 250.
- 1863 : 15. CROOKES and CHURCH. (Thallium sesquichloride.)  
Chem. News, 8, 1 ; Chem. Centrbl., 1864, 411 ; Jsb., 1863, 250.
- 1863 : 16. WILLM. (Ammonium derivatives of  $\text{TlCl}_3$ .)  
Bull. Soc. chim., 5, 354 ; Zeitschr. Chem. Pharm., 1863, 751 ; Chem. Centrbl., 1864, 410 ; Jsb., 1863, 251.
- 1863 : 17. CROOKES. (Nitrate, perchlorate.)  
Chem. News, 8, 195 ; Jsb., 1863, 252.  
(Phosphate, carbonate.)  
Chem. News, 8, 219 ; 8, 231 ; Jsb., 1863, 253.  
(Sulphate, chromates, acetate.)  
Chem. News, 8, 243 ; 8, 255 ; 8, 279 ; Jsb., 1863, 255.  
(All these salts.)  
Chem. Centrbl., 1864, 405 ; Zeitschr. anal. Chem., 2, 201.
- 1863 : 18. R. BÖTTGER. (New method of obtaining Tl. from fine dust. Its properties and compounds.)  
Jsb. Frank. phys. Ver., 1863, 4 ; Ann. Chem. Liebig, 128, 248 ; J. prakt. Chem., 90, 151 ; Rep. chim. app., 5, 485 ; Jsb., 1863, 248.
- 1863 : 19. PAULET. (Poisonous properties of Tl.)  
Compt. rend., 57, 494 ; Institut., 1863, 290 ; Chem. Centrbl., 1864, 287 ; Jsb., 1863, 255.
- 1863 : 20. GRANDEAU. (Poisonous properties of Tl.)  
Institut., 1863, 333 ; Jsb., 1863, 256.
- 1863 : 21. R. BÖTTGER. (Method of obtaining Tl. from lead-chamber deposits. Some Tl. compounds.)  
Jsb. des Frank. phys. Ver., 1861-62, 58 ; Ann. Chem. Liebig, 127, 175 ; J. prakt. Chem., 90, 22 ; Vierteljahrsschr. pr. Phar., 12, 365 ; Chem. Centrbl., 1863, 404 ; Dingl. pol. J., 168, 438 ; Ann. chim. phys. [3], 78, 500 ; Bull. Soc. chim., 5, 451 ; Jsb., 1863, 45.
- 1863 : 22. SCHRÖTTER. (Occurrence in lepidolite and mica.)  
Wien. Akad. Ber. [2], 48, 734 ; J. prakt. Chem., 91, 45 ; Chem. Centrbl., 1864, 864 ; Institut., 1864, 70 ; Chem. News, 9, 109 ; Jsb., 1864, 245.
- 1863 : 23. V. v. LANG. (Crystal form and optical properties of  $\text{Tl}_2\text{SO}_4$ .)  
Phil. Mag. [4], 25, 248 ; Ann. Chem. Liebig, 128, 76 ; Ann. der Phys. Pogg., 118, 630 ; Bull. Soc. chim., 5, 453 ; Chem. Centrbl., 1864, 141 ; Jsb., 1863, 254.

- 1864 : 1. G. WERTHER. (Determination as iodide.)  
Zeitschr. anal. Chem., 3, 1 ; J. prakt. Chem., 93, 393 ; Chem. Centrbl., 1864, 987 ; J. Pharm. [3], 46, 306 ; Jsb., 1864, 712.
- 1864 : 2. A. LAMY. (Alcoholates.)  
Ann. chim. phys. [4], 3, 373 ; Compt. rend., 59, 780 ; Instit., 1864, 370 ; J. Pharm. [4], 1, 211 ; Chem. News, 10, 268 ; Chem. Centrbl., 1865, 303 ; Am. J. Sci. [2], 39, 220 ; Jsb., 1864, 463.
- 1864 : 3. W. CROOKES. (Oxalates.)  
Chem. News, 9, 1 ; Bull. Soc. chim. [2], 1, 278 ; Chem. Centrbl., 1864, 410 ; Jsb., 1864, 254.
- 1864 : 4. W. CROOKES. (Solubility of Tl. salts.)  
Chem. News, 9, 37 ; Bull. Soc. chim. [2], 1, 266 ; Jsb., 1864, 256.
- 1864 : 5. ERDMANN. (Action of Thallium carbonate on vegetable colors.)  
J. prakt. Chem., 91, 317 ; Chem. Centrbl., 1864, 941 ; J. Pharm. [3], 46, 463 ; Jsb., 1864, 250.
- 1864 : 6. SCHÖNBEIN. (Behavior of Tl. in presence of O and H<sub>2</sub>O<sub>2</sub>.)  
J. prakt. Chem., 93, 35 ; Bull. Soc. chim. [2], 3, 180 ; Jsb., 1864, 170.
- 1864 : 7. A. SCHRÖTTER. (Separation of Li., Rb., Cs., and Tl. in lepidolite and mica.)  
Wien. Akad. Ber. [2], 50, 268 ; J. prakt. Chem., 93, 275 ; N. Jahr. Pharm., 23, 16, 65 ; Chem. Centrbl., 1865, 331 ; Jsb., 1864, 186.
- 1864 : 8. J. NICKLES. (Spectrum.)  
Compt. rend., 58, 132 ; Instit., 1864, 11 ; Bull. Soc. chim. [2], 1, 454 ; J. prakt. Chem., 92, 505 ; Ann. der Phys. Pogg., 121, 336 ; Chem. Centrbl., 1864, 404 ; Chem. News, 9, 54 ; Phil. Mag. [4], 28, 168 ; Jsb., 1864, 246.
- 1864 : 9. OETTINGER. (Molybdate and wolframate.)  
Zeitschr. Chem. Pharm., 1864, 440 ; J. Pharm. [3], 46, 463 ; Jsb., 1864, 253.
- 1864 : 10. BISCHOFF. (Occurrence.)  
Ann. Chem. Liebig, 129, 375 ; Dingl. pol. J., 172, 73 ; Chem. Centrbl., 1864, 815 ; Bull. Soc. chim. [2], 1, 349 ; J. Pharm. [3], 46, 308 ; Jsb., 1864, 245.
- 1864 : 11. KUHLMANN. (Thallous fluoride.)  
Compt. rend., 58, 1037 ; Bull. Soc. chim. [2], 3, 57 ; Chem. News, 10, 37 ; Jsb., 1864, 253.
- 1864 : 12. CROOKES. (Spectrum.)  
Chem. News, 9, 54 ; Jsb., 1864, 246.



## 1864 : 13. WERTHER.

J. prakt. Chem., 91, 385 : 92, 128, 351 ; Chem. Centrbl., 1864, 737 ;  
Bull. Soc. chim. [2], 2, 272 ; 3, 58 ; J. Pharm. [3], 46, 463 ; Chem.  
News, 10, 278 ; Jsb., 1864, 246.

## 1864 : 14. WILLM.

Bull. Soc. chim. [2], 2, 89 ; Jsb., 1864, 250.

## 1864 : 15. J. NICKLES. (Chloro- and bromo-ethers of Tl.)

Compt. rend., 58, 537 ; Instit., 1864, 89 ; J. Pharm. [4], 1, 23 ; Bull.  
Soc. chim. [2], 1, 467 ; Chem. News, 9, 241 ; J. prakt. Chem., 92,  
301 ; Chem. Centrbl., 1864, 412 ; Jsb., 1864, 252.

## 1865 : 1. WILLM.

Ann. chim. phys. [4], 5, 5 ; Bull. Soc. chim. [2], 4, 166 ; Zeitschr.  
Chem., 1865, 488 ; Jsb., 1865, 242.

## 1865 : 2. STRENG. (Occurrence in furnace products.)

Dingl. pol. J., 177, 329 ; Zeitschr. Chem., 1866, 95 ; Jsb., 1865, 242.

## 1865 : 3. R. BUNSEN.

Ann. Chem. Liebig, 133, 108 ; Zeitschr. Chem., 1865, 106 ; Dingl. pol.  
J., 175, 244 ; Viertschr. Pharm., 14, 592 ; Chem. Centrbl., 1866, 31 ;  
Ann. chim. phys. [4], 4, 499 ; Bull. Soc. chim. [2], 3, 418 ; Phil. Mag.  
[4], 29, 108 ; Jsb., 1865, 242.

## 1865 : 4. REID.

Chem. News, 12, 242 ; Zeitschr. Chem., 1866, 64 ; Jsb., 1865, 243.

## 1865 : 5. BUCHNER. (Fluorides.)

Wien. Akad. Ber. [2], 52, 644 ; J. prakt. Chem., 94, 404 ; Chem.  
Centrbl., 1866, 240 ; Jsb., 1865, 244.

## 1865 : 6. W. H. MILLER. (Crystalline form.)

Proc. Roy. Soc., 14, 555 ; Phil. Mag. [4], 31, 149 ; Jsb., 1865, 244.

## 1865 : 7. A. LAMY. (Phosphorus compounds.)

Compt. rend., 60, 741 ; Bull. Soc. chim. [2], 4, 193 ; Jour. Pharm. [4],  
1, 431 ; Zeitschr. Chem., 1865, 388 ; Chem. Centrbl., 1865, 597 ; Phil.  
Mag. [4], 29, 379 ; Ann. chim. phys. [4], 5, 410 ; Jsb., 1865, 246.

## 1865 : 8. HEBBERLING. (Estimation of Tl.)

Ann. Chem. Liebig, 134, 11 ; Chem. Centrbl., 1865, 657 ; N. Arch. ph.  
nat., 23, 113 ; Jsb., 1865, 249.

## 1865 : 9. A. SIRECKER. (Some Thallic salts.)

Ann. Chem. Liebig, 135, 207 ; J. prakt. Chem., 96, 334 ; Chem.  
Centrbl., 1865, 831 ; J. Pharm. [4], 2, 340 ; Phil. Mag. [4], 30, 256 ;  
Chem. News, 12, 136 ; Am. Jour. Sci. [2], 41, 114 ; Jsb., 1865, 252.

## 1866 : 1. NICKLES. (Behavior toward mercury.)

J. Pharm. [4], 4, 127 ; Jsb., 1866, 238.

- 1866 : 2. H. E. ROSCOE. (Thallous perchloride.)  
Chem. Soc. J. [2], 4, 127 ; Chem. News, 14, 217, 242 ; J. prakt. Chem., 101, 56 ; Zeitschr. Chem., 1866, 753 ; N. Arch. ph. nat., 28, 176 ; Jsb., 1866, 238.
- 1866 : 3. BIRNBAUM. (Action of  $H_2O_2$  on Tl.)  
Ann. Ch. u. Pharm., 138, 133 ; Jsb., 1866, 239.
- 1866 : 4. BUNSEN. (Spectrum.)  
Jsb., 1866, 779.
- 1866 : 5. LAMY. (Tl. Glass, Tl. and Pb. Glass.)  
Bull. Soc. chim. [2], 5, 164 ; Instit., 1866, 320 ; Zeitschr. Chem., 1866, 251 ; Chem. Centrbl., 1866, 799 ; 1867, 432 ; Phil. Mag. [4], 32, 385 ; Jsb., 1866, 865.
- 1866 : 6. DEBRAY. (Thallium phosphomolybdate.)  
Bull. Soc. chim. [2], 5, 404 ; Zeitschr. Chem., 1866, 478 ; Zeitschr. anal. Chem., 5, 381 ; J. prakt. Chem., 100, 64 ; Chem. Centrbl., 1866, 880 ; Vierteljahrschr. pr. Pharm., 16, 425 ; Jsb., 1866, 794.
- 1866 : 7. BÖTTGER. (Behavior of Tl. towards S. and sulphide of gold.)  
Jsb. phys. Ver. Frankfurt-a-M., 1865-66, 56 ; Jsb., 1866, 860.
- 1866 : 8. STREIT.  
J. prakt. Chem., 100, 191 ; Zeitschr. Chem., 1867, 384 ; Chem. Centrbl. 1867, 623 ; Jsb., 1867, 279.
- 1867 : 1. CROOKES. (Behavior of Tl. salts in presence of  $KMnO_4$ .)  
Chem. News, 15 ; Zeitschr. Chem., 1867, 412 ; Bull. Soc. chim. [2], 7, 394 ; N. Arch. ph. nat., 29 [?], 179 ; Jsb., 1867, 250.
- 1867 : 2. WÖHLER. (Preparation from pyrites.)  
Ann. Ch. Pharm., 142, 263 ; Bull. Soc. chim. [2], 9, 462 ; Phil. Mag., 34, 222 ; Jsb., 1867, 274.
- 1867 : 3. REGNAULD. (Amalgams.)  
Compt. rend., 64, 611 ; Instit., 1867, 109 ; J. Pharm. [4], 5, 251 ; J. prakt. Chem., 101, 255 ; Zeitschr. Chem., 1867, 349 ; Bull. Soc. chim. [2], 8, 179 ; Jsb., 1867, 275.
- 1867 : 4. OTTO. (Position among the elements.)  
J. prakt. Chem., 102, 185 ; Bull. Soc. chim. [2], 9, 212 ; Jsb., 1867, 275.
- 1867 : 5. CARSTANJEN. (Thallium and its compounds.)  
J. prakt. Chem., 102, 65, 129 ; Zeitschr. Chem., 1868, 69 ; Jsb., 1867, 275.
- 1867 : 6. WÖHLER. (Thallous chloride.)  
Ann. Chem. Liebig, 144, 250 ; J. prakt. Chem., 104, 127 ; Zeitschr. Chem., 1868, 124 ; Bull. Soc. chim. [2], 9, 463 ; Jsb., 1867, 281.

- 1867 : 7. CARSTANJEN. (Thallium acids.)  
J. prakt. Chem., 101, 55; Am. Jour. Sci. [2], 44, 269; Jsb., 1867, 282.
- 1867 : 8. F. ULLEK. (Tl. molybdanoxo-fluoride.)  
Ann. Chem. Liebig, 144, 204, 320; Wien. Akad. Ber. [2], 55, 767; J. prakt. Chem., 101, 61; Chem. Centrbl., 1867, 977; [Wien. Akad. Anz., 1867, 108]; N. Arch. ph. nat., 31, 152; Jsb., 1867, 236.
- 1867 : 9. LAMY. (Thallium.)  
Wien Akad. Anz., 1867, 187; J. prakt. Chem., 101, 61; Instit., 1867, 384; Jsb., 1867, 921.
- 1867 : 10. S. MELLOR. (Tl. and Mg. alloy.)  
Chem. News, 15, 245; J. prakt. Chem., 103, 508; Zeitschr. Chem., 1867, 475; Bull. Soc. chim. [2], 8, 259; Jsb., 1867, 896.
- 1868 : 1. WÖHLER. (Oxidation of Tl. in the circuit of a galvanic current.)  
Ann. Chem. Liebig, 146, 263, 375; Zeitschr. Chem., 1868, 385; Chem. Centrbl., 1868, 889; Bull. Soc. chim. [2], 10, 352; Jsb., 1868, 199.
- 1868 : 2. J. W. GUNNING. (Extraction of Thallium.)  
Scheikundige bijdragen uit het Laboratorium van het Athenaeum illustre te Amsterdam, I., 95; Arch. neerlandaises des sci. exactes et nat., III., 86; Zeitschr. Chem., 1868, 370; Zeitschr. anal. Chem., 7, 480; J. prakt. Chem., 105, 343; Bull. Soc. chim. [2], 10, 359; Chem. News, 17, 138; Jsb., 1868, 247.
- 1868 : 3. LAMY and DES CLOIZEAUX. (Chem., opt. and cryst. study of salts of Tl.)  
Comptes. rend., 66, 1146; Ann. chem. phys. [4], 17, 310, 484; Jsb., 1868, 252.
- 1868 : 4. H. FLEMMING. (Molybdate and silicate of Tl.)  
Jenaische Zeitschr. f. Med. u. Naturw., 4, 33; Zeitschr. Chem., 1868, 292; Bull. Soc. chim. [2], 10, 235; Jsb., 1868, 250.
- 1869 : 1. H. FIZEAU. (Heat expansion of Thallium.)  
Compt. rend., 68, 1125; Ann. der Phys. Pogg., 138, 26; Jsb., 1869, 86.
- 1869 : 2. H. C. SORBY. (Borax-bead reaction for Thallium.)  
Chem. News, 19, 309; Ber., 2, 337; Zeitschr. anal. Chem., 9, 100; Jsb., 1869, 912.
- 1869 : 3. A. LAMY. (Thallous oxide paper as a reagent for ozone.)  
Bull. Soc. chim. [2], 11, 210; Zeitschr. Chem., 1869, 416; Chem. Centrbl., 1869, 272; Ber., 2, 60; Zeitschr. anal. Chem., 9, 74; Jsb., 1869, 194.
- 1869 : 4. ZSCHIESCHE. (Double sulphides of Thallium with cerium and didymium.)  
J. prakt. Chem., 107, 98.

- 1869 : 5. LAMY and DES CLOIZEAUX. (Chemical and optical study of Thallium salts.)  
Ann. chim. phys. [4], 17, 310.
- 1869 : 6. ANGSTRÖM. (Thallium spectrum.)  
Ann. chim. phys. [4], 18, 235.
- 1870 : 1. BÖTTGER. (Preservation of lustre of Thallium under water.)  
Dingl. poly. J., 197, 379 ; Chem. Centrbl., 1870, 623 ; Jsb., 1870, 355.
- 1870 : 2. C. RAMMELSBERG. (Isomorphism of Thallium phosphate with alkali phosphates. Position among the elements.)  
Ber., 3, 276 ; Zeitschr. Chem. [2], 6, 570 ; Jsb., 1870, 356 ; Chem. Centrbl., 1871, 14.
- 1870 : 3. C. RAMMELSBERG. (Iodate and some double halides of Thallium.)  
Ber., 3, 360 ; Zeitschr. Chem. [2], 6, 606 ; Chem. Centrbl., 1872, 595 ; Jsb., 1870, 356.
- 1870 : 4. CHR. HANSEN. (Ethyl compounds of Thallium.)  
Ber., 3, 9 ; Zeitschr. Chem. [2], 6, 310 ; Chem. Centrbl., 1870, 82 ; Jsb., 1870, 507.
- 1870 : 5. R. SCHNEIDER and K. PREISS. (Thallium sulpho-platinate.)  
Ann. der Phys. Pogg., 138, 604 ; J. prakt. Chem. [2], 2, 162 ; Chem. Centrbl., 1870, 107.
- 1870 : 6. COSSA. (Thallium alum.)  
Nuovo Cimento [2], 3, 75 ; Zeitschr. Chem. [2], 6, 380 ; Chem. Centrbl., 1870, 470.
- 1871 : 1. A. CORNU. (Thallium spectrum.)  
Compt. rend., 73, 332 ; N. Arch. ph. nat., 42, 85 ; Phil. Mag. [4], 42, 237 ; Jsb., 1871, 174.
- 1871 : 2. R. J. FRISWELL. (Double cyanide of Thallium and platinum.)  
J. Chem. Soc., 24, 461 ; Ann. Chem. Liebig, 159, 383 ; Zeitschr. Chem. [2], 7, 414 ; Chem. News, 23, 249 ; Bull. Soc. chim. [2], 16, 87 ; Ber., 4, 529 ; Chem. Centrbl., 1871, 386 ; Jsb., 1871, 317.
- 1871 : 3. MAX SCHAFFNER. (Preparation of Thallium in large amounts.)  
Wien. Acad. Ber. [2], 63, 176 ; Chem. Centrbl., 1871, 594 ; Jsb., 1871, 987.
- 1871 : 4. F. v. KOBELL. (Occurrence in sphalerite.)  
J. prakt. Chem. [2], 3, 176 ; J. Chem. Soc., 24, 312 ; Zeitschr. anal. Chem., 11, 81 ; Chem. Centrbl., 1871, 308.
- 1871 : 5. J. THOMSEN. (Heat of neutralization of Thallium oxide.)  
Ann. der Phys. Pogg., 143, 354 ; 143, 497 ; Ber., 4, 309 and 588 ; Bull. Soc. chim. [2], 16, 63 ; Jsb., 1871, 104.

- 1871 : 6. ———. (Thallium in pigments.)  
Monit. scientif., 1871, 723; Deutsch. Industriezt., 1871, 418; Jsb. Chem. Tech., 1873, 7.
- 1872 : 1. F. WOHLER. (Preparation of metallic Thallium.)  
Ann. Chem. Lieb., 164, 74; J. Chem. Soc., 25, 880; Bull. chim. Soc. [2], 18, 448; Jsb. Chem. Tech., 1873, 5; Chem. Centrbl., 1872, 658; Jsb., 1872, 254.
- 1872 : 2. W. CROOKES. (Atomic weight of Thallium.)  
Proc. Roy. Soc., 20, 475; Chem. News, 26, 231; Ber., 5, 940; Zeitschr. anal. Chem., 13, 35; J. Chem. Soc., 25, 355; Chem. Centrbl., 1873, 62; Jsb., 1872, 254.
- 1872 : 3. M. JORGENSEN. (Thallous-thallic iodide.)  
J. prakt. Chem. [2], 6, 82; Bull. Soc. chim. [2], 18, 312; J. Chem. Soc., 26, 475; Jsb., 1872, 254.
- 1872 : 4. RAMMELSBERG. (Isomorphism of Thallium salts with those of univalent elements.)  
Ann. der Phys. Pogg., 146, 592; J. Chem. Soc., 25, 987.
- 1872 : 5. BOLTON. (Thallium uranate.)  
Amer. Chemist., 1872, 2, 456; Jsb., 1872, 255.
- 1872 : 6. G. SPEZIA. (Determination of iodine in presence of chlorine by Thallous nitrate.)  
Zeitschr. anal. Chem., 11, 397; Chem. Centrbl., 1873, 183.
- 1873 : 1. L. DE BOISBAUDRAN. (Spectrum of Thallium.)  
Compt. rend., 77, 1152; Jsb., 1873, 152.
- 1873 : 2. CARNELLY. (Vanadates of Thallium.)  
J. Chem. Soc., 26, 323; Ann. Chem. Lieb., 166, 155; Ber., 6, 774; Chem. Centrbl., 1873, 226; Jsb., 1873, 279.
- 1873 : 3. C. A. VALSON. (Refraction of Thallium salt solutions.)  
Compt. rend., 76, 224; Gazz. chim. ital., 1873, 134; Jsb., 1873, 135.
- 1873 : 4. STOLBA. (Separation of Thallium from flue dust. Thallium alum.)  
Ber. der. Königl. böhm. Ges. d. Wissen., 1873, Nov.; J. Chem. Soc., 27, 873; Chem. Centrbl., 1874, 118; Jsb., 1873, 282.
- 1873 : 5. RAMMELSBERG. (Hypophosphite of Thallium.)  
J. Chem. Soc., 26, 2.
- 1873 : 6. C. FRONMÜLLER. (Thallous cyanide.)  
Ber., 6, 1176; J. Chem. Soc., 27, 147.
- 1874 : 1. PHIPSON. (Determination of Thallium.)  
Compt. rend., 78, 563; J. Chem. Soc., 27, 882; Chem. Centrbl., 1874, 285; Jsb., 1874, 996.

- 1874 : 2. F. C. HARTWIG. (Compounds of Thallium with alcohol radicals.)  
Ber., 7, 296; J. Chem. Soc., 27, 673; Chem. Centrbl., 1874, 296.
- 1874 : 3. CARUS and FROXTILLER. (Thallium triethyl.)  
Ber., 7, 262; Chem. Centrbl., 1874, 266.
- 1874 : 4. TH. KÖSEL. (Iodine compounds of Thallium.)  
Ber., 7, 576 and 668; J. Chem. Soc., 27, 773.
- 1874 : 5. H. SCHRÖDER. (Isomorphism of Thallium and ammonium salts.)  
Ber., 7, 676.
- 1874 : 6. TROOST and HATTEFEUILLE. (Behavior of Thallium toward hydrogen.)  
Ann. chim. phys. [5], 2, 279; Compt. rend., 78, 807; Dingl. poly. J., 214, 226; Jsb., 1874, 220.
- 1875 : 1. J. THOMSEN. (Thermo-chemical study of some Thallium compounds.)  
J. prakt. Chem., 12, 98; Bull. Soc. chim., 26, 150; Chem. Centrbl., 1875, 578; Jsb., 1875, 83.
- 1875 : 2. R. SCHNEIDER. (Thallium-sodium sulphide.)  
Ann. der Phys. Pogg., 153, 568; J. Chem. Soc., 28, 533.
- 1875 : 3. H. LESCOEUR. (Diacetate of Thallium.)  
Bull. Soc. chim., 24, 516; Chem. Centrbl., 1876, 35.
- 1875 : 4. HAMMERBACHER. (Occurrence of Thallium in carnallite.)  
Ann. Chem. Liebig, 176, 82; J. Chem. Soc., 28, 734; Chem. Centrbl., 1875, 220.
- 1875 : 5. F. HARTWIG. (Thallium in union with alcohol radicals.)  
Ann. Chem. Liebig, 176, 257; J. Chem. Soc., 28, 1002.
- 1875 : 6. J. KRAUSE. (Preparation of Thallium.)  
Dingl. poly. J., 217, 323; J. Chem. Soc., 28, 519; Chem. [Centrbl., 1875, 643; Jsb., 1875, 216.
- 1875 : 7. R. NIETZKI. (Preparation of Thallium.)  
Arch. Pharm. [3], 7, 885; Chem. Centrbl., 1877, 778; Jsb., 1875, 216.
- 1875 : 8. R. BÖTTGER. (Behavior of Thallic oxide toward "Goldschwefel.")  
N. Rep. Pharm., 24, 243; Pol. Notizbl., 33, 81; Chem. Centrbl., 1878, 271; Jsb., 1875, 216.
- 1876 : 1. T. E. THORPE. (Isometric relations of Thallium.)  
J. Chem. Soc., 29, 859; Ber., 9, 952; Chem. News, 33, 156; Chem. Centrbl., 1876, 466.

- 1876 : 2. JOHN MUIR. (Thallium chlorate.)  
J. Chem. Soc., 29, 857; Ber., 9, 952; Chem. News, 33, 156; Chem. Centrbl., 1876, 486; Jsb., 1876, 258.
- 1876 : 3. E. J. CHAPMAN. (Blowpipe reactions of Thallium.)  
Phil Mag. [2], 2, 397; J. Chem. Soc., 31, 489; Chem. News, 35, 13; Jsb., 1876, 995.
- 1876 : 4. R. NIETZKI. (Preparation and determination of Thallium.)  
Dingl. poly. J., 219, 262; Zeitschr. anal. Chem., 16, 472; Jsb., 1876, 1072; Jsb., 1877, 1069.
- 1876 : 5. C. FRONMÜLLER. (Double cyanides of Thallium.)  
Inaug. dis. Marburg, 1876; Jsb., 1876, 816.
- 1877 : 1. R. J. FRISWELL and A. J. GREENAWAY. (Thallous platino-cyanide.)  
J. Chem. Soc., 32, 251; Ber., 10, 1858; Chem. News, 35, 272; Bull. Soc. chim., 30, 120; Chem. Centrbl., 1877, 548; Jsb., 1877, 314.
- 1877 : 2. J. J. ACKWORTH and H. E. ARMSTRONG. (Action of nitric acid on Thallium.)  
J. Chem. Soc., 32, 86.
- 1877 : 3. PETER CLAESSON. (Thallium mercaptide.)  
J. prakt. Chem., 15, 198; J. Chem. Soc., 32, 394; Jsb., 1877, 519.
- 1877 : 4. H. KUPFERBERG. (Thallium salicyl-anilid.)  
J. prakt. Chem., 16, 434; J. Chem. Soc., 34, 319; Jsb., 1877, 753.
- 1878 : 1. H. E. ROSCOE. (Density of vapor of Thallous chloride.)  
Ber., 11, 1196; J. Chem. Soc., 34, 987; Chem. Centrbl., 1878, 594.
- 1878 : 2. C. FRONMÜLLER. (Some double salts of Thallous cyanide.)  
Ber., 11, 91; Bull. Soc. chim., 30, 339; J. Chem. Soc., 34, 394; Chem. Centrbl., 1878, 178; Jsb., 1878, 291.
- 1878 : 3. A. COSSA. (Thallium alum in volcanic regions.)  
Acad. dei Lincei, S. III., 2; Gazz. chim. ital., 1878, 235; Zeitschr. Kryst., 2, 509; Ber., 11, 811; Jsb., 1878, 1225.
- 1878 : 4. F. W. CLARKE. (Thallous tellurate.)  
Ber., 11, 1507; Am. J. Sci. [3], 6, 201; J. Chem. Soc., 36, 1004.
- 1878 : 5. L. F. NILSON. (Thallium plato-iodo-nitrite.)  
Ber., 11, 681.
- 1878 : 6. T. W. SALTER. (Thallium chromates as pigments.)  
Chem. News, 37, 96; J. Chem. Soc., 34, 454; Jsb., 1878, 291.
- 1878 : 7. E. SCHÖNE. (Oxygen compounds of Thallium and Hydrogen peroxide.)  
Ann. Chem. Lieb., 196, 58; Bull. Soc. chim., 29, 588; Jsb., 1878, 196.



- 1878 : 8. G. CIAMICIAN. (Spectrum of Thallium.)  
Ber. Wien. Acad. [2], 76, 499.
- 1878 : 9. LIVEING and DEWAR. (Spectrum of Thallium.)  
Proc. Roy. Soc., 27, 132 ; 27, 350 ; 27, 494 ; Jsb., 1878, 182.
- 1879 : 1. A. DITTE. (Acid Thallium nitrate.)  
Compt. rend., 89, 576 ; Chem. Centrbl., 1879, 722.
- 1879 : 2. J. THOMSEN. (Thermo-chemical study of Thallium compounds.)  
J. prakt. Chem. [2], 19, 13 ; Jsb., 1878, 92.
- 1879 : 3. D. PLAYFAIR. (Occurrence of Thallium in pyrites.)  
Chem. News, 39, 245 ; Dingl. poly. J., 234, 160 ; Jsb., 1879, 206.
- 1879 : 4. GOUY. (Spectrum of Thallium.)  
Ann. chim phys. [5], 18, 58.
- 1880 : 1. J. THOMSEN. (Further thermo-chemical study of Thallium compounds.)  
J. prakt. Chem., 21, 38 ; 21, 449 ; Chem. Centrbl., 1880, 390.
- 1880 : 2. L. SCHUCHT. (Electrolytic determination of Thallium.)  
Berg. u. Hüttenm. Zeit., 39, 121 ; Chemikerzeit, 1880, 292 ; Zeitschr. anal. Chem., 22, 241 ; Chem. Centrbl., 1880, 374 ; Jsb., 1880, 174.
- 1880 : 3. L. F. NILSON. (Thallium plato-iodo-nitrite.)  
J. prakt. Chem. [2], 29, 182 ; Chem. Centrbl., 1880, 261.
- 1880 : 4. ALFRED POLIS. (Thallium chrome alum.)  
Ber., 13, 367.
- 1880 : 5. EM. SCHÖNE. (Action of oxygen on Thallium paper.)  
Ber., 13, 1508.
- 1881 : 1. F. PARMENTIER. (Thallium silico-molybdate.)  
Compt. rend., 92, 1234 ; J. Chem. Soc., 40, 880.
- 1882 : 1. M. SCHROEDER. (Thallium paper as an indicator in titration with sodium sulphide.)  
Berg. u. Hüttenm. Zeit., 40, 4 ; Ber., 15, 262 ; Chem. Tech. Jsb., 1882, 170.
- 1882 : 2. ROSS. (Blowpipe reactions of Thallium.)  
Berg. u. Hüttenm. Zeit., 40, 459 ; Chem. Centrbl., 1882, 54.
- 1882 : 3. RAMMELSBERG. (Thallium phosphate.)  
Sitzungsb. d. k. Preuss. Akad. d. Wissensch., 1882, 283 ; Ber., 15, 2228 ; J. Chem. Soc., 44, 424 ; Bull. Soc. chim., 39, 64 ; Ann. der. Phys. Pogg. [2], 16, 694 ; Chem. Centrbl., 1882, 450.



- 1882 : 4. O. PAVEL. (Thallium nitroso-sulphide.)  
Ber., 15, 2600 ; Jsb., 1882, 292.
- 1882 : 5. W. N. HARTLEY. (Spectrum of Thallium.)  
J. Chem. Soc., 41, 84.
- 1883 : 1. L. SCHUCHT. (Electrolytic behavior of Thallium.)  
Zeitschr. anal. Chem., 22, 490 ; Jsb., 1883, 222, 1512.
- 1883 : 2. J. SCHRAMM. (Occurrence and position among the elements.)  
Ann. Chem. Liebig, 219, 374 ; J. Chem. Soc., 44, 954 ; Ber., 16, 2662 ;  
Bull. Soc. chim., 41, 646 ; Jsb., 1883, 11.
- 1883 : 3. DONATH and MAYRHOFER. (Affinity, atomic weight, and specific gravity of Thallium.)  
Ber., 16, 1588 ; Jsb., 1883, 26.
- 1883 : 4. W. SPRING. (Thallium alum.)  
Ber., 16, 2723 ; Belg. Acad. Bull. [3], 6, 507 ; Bull. Soc. chim., 40, 575 ;  
Jsb., 1883, 102.
- 1883 : 5. H. BECQUEREL. (Spectrum.)  
Compt. rend., 97, 71 ; Ann. chim. phys. [5], 30, 49 ; Jsb., 1883, 244.
- 1884 : 1. RAMMELSBERG. (Phosphate of Thallium.)  
Ann. Wied., 20, 928 ; J. Chem. Soc., 46, 395.
- 1884 : 2. R. WEBER. (Thallium pyrosulphate.)  
Ber., 17, 2502 and 2707.
- 1884 : 3. CARNELLEY and O'SHEA. (Melting-point of Thallous oxide.)  
J. Chem. Soc., 45, 409.
- 1884 : 4. B. RATHKE. (Thallium compounds with thiourea.)  
Ber., 17, 297 ; Jsb., 1884, 504.
- 1884 : 5. D. TOMMASI. (Heat of formation of Thallous hydrate.)  
Bull. Soc. chim. [2], 41, 444 ; Compt. rend., 98, 812 ; Jsb., 1884, 355.
- 1884 : 6. A. G. PAGE. (Chlorides of Thallium.)  
Ann. Chem. Liebig, 225, 201.
- 1884 : 7. H. BECQUEREL. (Spectrum.)  
Compt. rend., 99, 374 ; Jsb., 1884, 291.
- 1884 : 8. BRIX. (Thallium chloride and iodide, and some organic salts.)  
Ann. Chem. Liebig, 225, 160.
- 1885 : 1. P. KULISCH. (Action of phosphine on a Thallium solution.)  
Ann. Chem. Liebig, 231, 348 ; Chem. Centrbl., 1885, 431 ; Jsb., 1885, 431.

- 1886 : 1. O. ZIMMERMANN. (Occurrence in commercial uranium oxide.)  
Ann. Chem. Liebig, **232**, 273 ; Jsb., 1886, 267.
- 1886 : 2. TH. ROSENBLADT. (Thallium-cobalt nitrate.)  
Ber., **19**, 25, 35 ; J. Chem. Soc., **52**, 13.
- 1886 : 3. E. A. WERNER. (Determination of Thallium in presence of lead.)  
Chem. News, **53**, 51 ; Ber., **19**, Ref. 220 ; J. Chem. Soc., **50**, 490 ;  
Chem. Centrbl., 1886, 171.
- 1886 : 4. OSTWALD. (Electrical conductivity of Thallous hydrate.)  
J. prakt. Chem. [2], **33**, 352 ; Jsb., 1886, 267.
- 1886 : 5. KOSMAN. (Thallium in crude zinc.)  
Chem. Zeit., **10**, 762 ; J. Chem. Soc., **50**, 851.
- 1887 : 1. A. C. COUSINS. (Relation to gold and mercury.)  
Chem. News, **55**, 241 ; Jsb., 1887, 375.
- 1887 : 2. H. N. WARREN. (Thallium in platinum.)  
Chem. News, **55**, 241 ; Ber., **20**, R. 483 ; J. Chem. Soc., **52**, 702 ;  
Monit. scientif. [4], **1**, 1103 ; Chem. Centrbl., 1887, 875 ; Jsb., 1887,  
2433.
- 1887 : 3. A. PICCINI. (Acid oxides of Thallium.)  
Gazz. chim. ital., **17**, 450 ; J. Chem. Soc., **54**, 110 ; Ber., **21**, 224 ;  
Chem. Centrbl., 1888, 30 ; Jsb., 1887, 545.
- 1888 : 1. W. C. R.-AUSTIN. (Periodic properties.)  
Proc. Roy. Soc., **43**, 425 ; Chem. News, **57**, 133.
- 1888 : 2. B. LEPSIUS. (Valence of Thallium.)  
Ber., **21**, 556 ; Jsb., 1888, 455.
- 1888 : 3. CARNELLEY and WALKER. (Dehydration of Thallous oxide by heat.)  
J. Chem. Soc., **53**, 59.
- 1888 : 4. G. NEUMANN. (Double salts of Thallium chloride.)  
Ann. Chem. Liebig, **244**, 329 ; J. Chem. Soc., **54**, 655 ; Ber., **21**, R.  
426 ; Chem. Centrbl., 1888, 710.
- 1888 : 5. G. NEUMANN. (Determination of Thallium.)  
Ann. Chem. Liebig, **244**, 349 ; J. Chem. Soc., **54**, 529 ; Ber., **21**, 356 ;  
Bull. Soc. chim., **50**, 67 ; Chem. Centrbl., 1888, 730.
- 1888 : 6. SCHUMANN. (Extraction of Thallium from zinc.)  
Ann. Chem. Liebig, **249**, 340.
- 1888 : 7. K. KLUSS. (Thallium dithionate.)  
Ann. Chem. Liebig, **246**, 220 ; J. Chem. Soc., **54**, 1156 ; Jsb., 1888, 481.

- 1889 . 1. HEYCOCK and NEVILLE. (Properties of Thallium-sodium alloy.)  
J. Chem. Soc., **55**, 671.
- 1889 : 2. W. RAMSAY. (Molecular weight of Thallium.)  
J. Chem. Soc., **55**, 531.
- 1889 : 3. BEILSTEIN and V. BLASE. (Thallium antimoniate.)  
Melanges Phys. Chim. Bull. St. Petersburg. **13**, 1 : Chem. Centrbl., 1889, 803 ; J. Chem. Soc., **56**, 1123.
- 1889 : 4. W. FEIT. (Determination of Thallium.)  
Zeitschr. anal. Chem., **28**, 314 ; Ber., **22**, 512 ; J. Chem. Soc., **56**, 927 ; Chem. Centrbl., 1889, 195.
- 1889 . 5. H. BILTZ and V. MEYER. (Vapor density of Thallium.)  
Ber., **22**, 725 ; J. Chem. Soc., **56**, 673 ; Zeitschr. phys. Chem., **4**, 249 ; Chem. Centrbl., 1889, 531 ; Jsb., 1889, 127.
- 1889 : 6. A. CARNOT. (Volumetric determination of Thallium.)  
Compt. rend., **109**, 177 ; J. Chem. Soc., **56**, 1246 ; Zeitschr. anal. Chem., **33**, 462 ; Ber., **22**, 707 ; Chem. Centrbl., 1889, 514 ; Jsb., 1889, 2424.
- 1889 . 7. A. BRAND. (Electrical behavior of Thallium pyrophosphate.)  
Zeitschr. anal. Chem., **28**, 595.
- 1889 : 8. F. L. BARTLETT. (Preparation from zinc blende.)  
Chem. Soc. Ind. J., **3**, 896 ; Jsb., 1889, 341.
- 1889 . 9. D. CARNEGIE. (Oxides and hydrates of Thallium.)  
Chem. News, **60**, 113 ; Ber., **22**, 656 ; J. Chem. Soc., **58**, 109 ; Chem. Centrbl., 1889, 738 ; Jsb., 1889, 521.
- 1889 : 10. C. SORET and L. DUPARC. (Specific gravity of Thallium alum.)  
Arch. phys. nat. Geneve, **21**, 90 ; Chem. Centrbl., 1889, 411.
- 1890 : 1. J. H. LONG. (Optical properties of Thallium-tartrate solutions.)  
Am. J. Sci. [3], **38**, 264 ; J. Chem. Soc., **58**, 313.
- 1890 : 2. HEYCOCK and NEVILLE. (Physical properties of Thallium-tin alloy.)  
J. Chem. Soc., **57**, 379.
- 1890 : 3. G. WYROUBOFF. (Some new compounds of Thallium carbonate.)  
B. Mfr., **12**, 536 ; Chem. Centrbl., 1890, 575.
- 1890 : 4. SCHNEIDER. (Thallium-potassium sulphide.)  
J. prakt. Chem. [2], **42**, 305 ; Ber., **23**, R. 691 ; J. Chem. Soc., **60**, 16.

- 1890 : 5. WINKLER. (Reduction of the oxide by magnesium.)  
Ber., 23, 788 ; J. Chem. Soc., 58, 693.
- 1890 : 6. J. BLAKE. (Physiological action of Thallium salts.)  
Compt. rend., 111, 57 ; Ber., 23, R. 594 ; J. Chem. Soc., 58, 1452.
- 1891 : 1. RAMMELSBERG. (Thallium hypophosphate.)  
Math. nat. Mitt. Sitz-Akad. Wiss., Ber., 1891, 369 ; J. Chem. Soc., 62, 403 ; Chem. Centrbl., 1891 (2). 790.
- 1891 : 2. H. BAUBIGNY. (Determination of Thallium.)  
Compt. rend., 113, 544 ; Ber., 24, R. 920 ; J. Chem. Soc., 62, 238.
- 1891 : 3. SUDBOROUGH. (Action of nitrosyl chloride on Thallium.)  
J. Chem. Soc., 59, 657.
- 1891 : 4. BEHRENS. (Microchemical reactions of Thallium.)  
Zeitschr. anal. Chem., 30, 138 ; Chem. News, 64, 41.
- 1891 : 5. LEPIERRE and LACHAUD. (Thallous chromate.)  
Compt. rend., 113, 196 ; Ber., 24, R. 698 ; J. Chem. Soc., 60, 1422 ;  
Jahrbuch, 1891, 87.
- 1891 : 6. H. W. B. ROOZEBOOM. (Solution of mixed crystals of Thallous and potassium chlorate.)  
Zeitschr. phys. Chem., 8, 513 ; J. Chem. Soc., 62, 266 ; Jahrbuch, 1891, 40.
- 1891 : 7. J. H. LONG. (Determination of Thallium and solubility of Thallous iodide.)  
J. anal. Chem., 2, 243 ; Zeitschr. anal. Chem., 30, 342 ; J. Chem. Soc., 60, 1295.
- 1892 : 1. K. SPONHOLZ. (Volumetric determination of Thallium.)  
Zeitschr. anal. Chem., 31, 519 ; Chem. News, 67, 187 ; Ber., 26, R. 157.
- 1892 : 2. JANNASCH and ASCHOFF. (Separation of chlorine and iodine by Thallous-sulphate solution.)  
Zeitschr. anorg. Chem., 1, 248 ; Jahrbuch, 1892, 77.
- 1892 : 3. SEUBERT and ELTEN. (Thallous sulphite.)  
Zeitschr. anorg. Chem., 2, 434 ; Ber., 26, R. 150 ; Jahrbuch, 1892, 82 ;  
J. Chem. Soc., 64, 456 ; Zeitschr. anorg. Chem., 4, 68.
- 1892 : 4. RAMMELSBERG. (Acid and normal phosphates of Thallium.)  
J. prakt. Chem., 45, 156.
- 1892 : 5. RAUTER. (Action of Thallous oxide on silicon tetrachloride.)  
Ann. Chem. Liebig, 270, 249.
- 1892 : 6. HEYCOCK and NEVILLE. (Thallium-cadmium and Thallium-lead alloys.)  
J. Chem Soc., 61, 903, 914.

- 1892 : 7. LEPIERRE and LACHAUD. (Thallous chromate and Thallous chloro-chromate.)  
Bull. Soc. chim. [3], 6, 230 ; J. Chem. Soc., 62, 567.
- 1893 : 1. F. MAURO. (Thallium fluor-oxymolybdate.)  
Atti. Roy. Accad. Lincei [5], 2, II, 382 ; Ber., 27, R. 109 ; Zeitschr. anorg. Chem., 6, 338.
- 1893 : 2. A. JOLY. (Thallium hypophosphate.)  
Compt. rend., 118, 649 ; Zeitschr. anorg. Chem., 6, 427 ; Bull. Soc. chim. [3], 11, 670 ; Ber., 27, R. 240 ; Chem. Centrbl., 1894 (1), 819 ; J. Chem. Soc., 66 (2), 282.
- 1893 : 3. K. SPONHOLZ. (Determination of Thallium by titration with bromine water.)  
Zeitschr. anal. Chem., 31, 519 ; Ber., 26, R. 157 ; Zeitschr. anorg. Chem., 3, 239.
- 1893 : 4. LEPIERRE. (Atomic weight of Thallium.)  
Compt. rend., 116, 580 ; Ber., 26, R. 267 ; Bull. Soc. chim. [3], 9, 166 ; Zeitschr. anorg. Chem., 4, 316 ; Jahrbuch, 1893, 95 ; Chem. Centrbl., 1893, 716.
- 1893 : 5. HODGKINSON and FRENCH. (Action of ammonia on Thallous sulphate.)  
Chem. News, 66, 223 ; Ber., 26, R. 183.
- 1893 : 6. E. GLATZEL. (Thiophosphate of Thallium.)  
Zeitschr. anorg. Chem., 4, 186 ; Ber., 26, R. 577 ; Chem. Centrbl., 1893, 350.
- 1893 : 7. LEPIERRE. (Atomic weight of Thallium.)  
Bull. Soc. chim. [3], 11, 423 ; Zeitschr. anal. Chem., 33, 135 ; Chem. Centrbl., 1894 (2), 18.
- 1893 : 8. PRIBRAM. Tartrate.  
Monatshefte, 14, 742.
- 1893 : 9. H. KAYSER. (Spectrum of Thallium.)  
Chem. Zeitung, 16, 533 ; Zeitschr. anal. Chem., 32, 573.
- 1893 : 10. J. W. RETGERS. (Solubility of Thallous iodide in methyl iodide.)  
Zeitschr. anorg. Chem., 3, 346.
- 1893 : 11. J. W. RETGERS. (Thallous-silver nitrate for mineral separations.)  
Neues Jarhb. Min. Geol., 1893, 1, 90 ; Zeitschr. anorg. Chem., 4, 322 ; J. Chem. Soc., 65 (2), 294 ; Chem. Centrbl., 1894, 442.

## 1893 : 12. WILDE. (Spectrum.)

Proc. Roy. Soc., 53, 369 ; J. Chem. Soc., 64 (2), 525 ; Zeitschr. anorg. Chem., 5, 399.

## 1893 : 13. E. SCACCHI. (Crystallographic study of Thallium fluoxymolybdate.)

Atti. Roy. Accad. dei Lincei [5], 2, II, 401 ; Z. Kryst., 25, 388 ; Ber., 27, R. 109 ; Chem. Centrbl., 1894, (1), 456.

## 1893 : 14. A. A. NOYES and C. W. HAPGOOD. (Isomorphism of Thallous nitrate and diphenyl nitrate.)

Chem. News, 74, 217.

## 1893 : 15. W. N. HARTLEY. (Spectrum.)

J. Chem. Soc., 63, 139.

## 1893 : 16. D. COCHIN. (Spectrum.)

Compt. rend., 116, 1055 ; J. Chem. Soc., 64 (2), 402.

## 1894 : 1. HEYCOCK and NEVILLE. (Freezing-points of some Thallium alloys.)

J. Chem. Soc., 65, 31 ; Ber., 27, R. 240 ; Ber., 28, R. 218 ; Bull. Soc., chim. [3], 12, 515.

## 1894 : 2. G. GIORGIS. (Acid Thallium carbonate.)

Atti. R. Accad. dei Lincei [5], 3, II, 104 ; Ber., 27, R. 859 ; J. Chem. Soc., 68 (2), 316 ; Zeitschr. anorg. Chem., 8, 404 ; Jahrbuch, 1894, 93 ; Chem. Centrbl., 1894, 773.

## 1894 : 3. PENFIELD and KREIDER. (Separation of minerals of high specific gravity by Thallium-silver nitrate.)

Am. Jour. Sci. [3], 48, 141 ; Chem. Centrbl., 1894 (2), 530.

## 1894 : 4. H. L. WELLS and S. L. PENFIELD. (Thallium tri-iodide.)

Zeitschr. anorg. Chem., 6, 312 ; J. Chem. Soc., 66 (2), 318 ; Jahrbuch, 1894, 92 ; Am. Jour. Sci. [3], 47, 463 ; Ber., 27, R. 494 ; Chem. Centrbl., 1894 (2), 8.

## 1894 : 5. OTTO VOGEL. (Occurrence and spectrum of Thallium.)

Zeitschr. anorg. Chem., 5, 49 ; Zeitschr. anorg. Chem., 5, 61.

## 1894 : 6. R. SCHARIZER. (Crystallographic examination of Thallium tartrate.)

Zeitschr. Kryst., 23, 565 ; Chem. Centrbl., 1894 (2), 1034 ; Chem. Centrbl., 1895 (2), 71.

## 1895 : 1. ANTONIO CURCI. (Biological action of Thallium.)

Annal. Chim. Farm., 22, 481 ; Chem. Centrbl., 1895, 838 ; Chem. Centrbl., 1896, 120.

- 1895 : 2. J. H. PRATT. (Double halides of Thallium with metals of the alkalies.)  
Zeitschr. anorg. Chem., **9**, 19 ; Am. J. Sci. [3], **49**, 397 ; J. Chem. Soc., **68** (2), 398 ; Chem. Centrbl., 1895, 7.
- 1895 : 3. A. STAVENHAGEN. (Thallium arsenite.)  
J. prakt. Chem. [2], **51**, 1 ; J. Chem. Soc., **68** (2), 218.
- 1895 : 4. INGLESTRÖM. (Occurrence in hæmatite.)  
Zeitschr. Kryst., **25**, 94 ; J. Chem. Soc., **68** (2), 505.
- 1895 : 5. J. A. KRENNER. (Occurrence in lorandite.)  
Math. nat. Ber. Ungarn., **12** ; Chem. News., **71**, 91.
- 1896 : 1. L. M. DENNIS, M. DOAN, and A. C. GILL. (Thallous trinitride, Thallous-thallic trinitride, Thallous tellurate, and Thallous cyanplatinite.)  
J. Amer. Chem. Soc., **18**, 970 ; Chem. Centrbl., 1897 (1), 16.
- 1896 : 2. J. W. RETGERS. (Double nitrate of Thallium with silver, lead, and mercury.)  
Jahrb. f. Mineral., 1896 (2), 183 ; Chem. Centrbl., 1897 (1), 71.
- 1896 : 3. H. BILTZ. (Density of Thallium.)  
Ber. d. Königl. Preuss. Akad., **5**, 67 ; Ber., **29** (4), 161.
- 1896 : 4. H. BILTZ. (Molecular weight of Thallium.)  
Zeitschr. phys. Chem., **19**, 385.
- 1896 : 5. J. ANTIPOW. (Occurrence in iron pyrites.)  
J. Russ. phys. chem. Ges., 1896 (1), 384. ; Ber., **29**, Ref. 1042.

## AUTHOR INDEX.

- Ackworth, J. J., and H. E. Armstrong. Action of nitric acid on Thallium, 15.
- Angström, Spectrum, 12.
- Antipow, J. Occurrence in iron pyrites, 23.
- Armstrong, H. E., and J. J. Ackworth. Action of nitric acid on Thallium, 15.
- Aschoff and Jannasch. Separation of chlorine and iodine by Thallous sulphate, 20.
- Bartlett, F. L. Preparation from zinc blende, 19.
- Baubigny, H. Determination of Thallium, 20.
- Becquerel, H. Spectrum, 17.
- Behrens. Microchemical reactions, 20.
- Beilstein and v. Blase. Thallium antimoniate, 19.
- Biltz, H. Density, 23; molecular weight, 23.
- Biltz, H., and V. Meyer. Vapor density, 19.
- Birnbaum. Action of hydrogen peroxide on Thallium, 10.
- Bischoff. Occurrence, 8.
- Blake, J. Physiological action of salts, 20.
- v. Blase and Beilstein. Thallium antimoniate, 19.
- Böttger. Occurrence, methods of obtaining from flue-dust and lead-chamber deposits, some compounds, 7; occurrence, 6; behavior towards sulphur and sulphide of gold, 10; preservation of lustre under water, 12; behavior of oxide, 14.
- de Boisbaudran, L. Spectrum, 13.
- Bolton. Uranate, 13.
- Brand, A. Electrical behavior of the pyrophosphate, 19.
- Brix. Chloride, iodide, and some organic salts, 17.
- Buchner. Fluorides, 9.
- Bunsen. 9; spectrum, 10.
- Carius and Fronmüller. Triethyl, 14.
- Carnegie, D. Oxides and hydrates, 19.
- Carnelley. Vanadates, 13.
- Carnelley and O'Shea. Melting-point of Thallous oxide, 17.
- Carnelley and Walker. Dehydration of Thallous oxide, 18.
- Carnot, A. Volumetric determination, 19.
- Carstanjen. Thallium and its compounds, 10; Thallium acids, 11.
- Chapman, E. J. Clowpipe reactions, 15.
- Ciamician, G. Spectrum, 16.
- Claesson, Peter. Mercaptide, 15.
- Clarke, F. W. Thallous tellurate, 15.
- Des Cloizeau and Lamy. Chemical, optical, and crystallographic study of salts, 11, 12.
- Cornu, A. Spectrum, 12.
- Cossa, A. Thallium alum, 12, 15.
- Cousins, A. C. Relation to gold and mercury, 18.
- Crookes, W. Discovery, 5; preparation, 6; priority of discovery, 6; salts, 7; oxalates, 8; solubilities of salts, 8; spectrum, 8; behavior of salts in presence of potassium permanganate, 10; atomic weight, 13.
- Crookes, W., and Church. Sesquichloride, 7.
- Curci, A. Biological action, 22.
- Debray. Thallium phosphomolybdate, 10.
- Dennis, L. M., M. Doan, and A. C. Gill. Thallous trinitride, Thallous-Thallic trinitride, Thallous tellurate, and Thallous cyanplatinite, 23.
- Dewar and Liveing. Spectrum, 16.
- Ditte, A. Acid Thallium nitrate, 16.
- Doan, M. See Dennis, L. M.
- Donath and Mayrhofer. Affinity, atomic weight, and specific gravity, 17.
- Duparc L., and C. Soret. Specific gravity of Thallium alum, 19.
- Elten and Seubert. Thallous sulphite, 20.
- Erdmann. 7; Thallous carbonate on vegetable colors, 8.
- Feit, W. Determination, 19.
- Fizeau, H. Heat expansion, 11.
- Flemming, H. Molybdate and silicate, 11.
- French and Hodgkinson. Action of ammonia on Thallous sulphate, 21.
- Friswell, R. J. Thallous platino-cyanide, 12.



- Finckell, R. J., and A. J. Greenaway. Thallous platino-cyanide, 15.
- Fronmüller, C. Double salts of Thallous cyanide, 15.
- Fronmüller and Carius. Thallium triethyl, 14.
- Gassiot. Spectrum, 6.
- Gill, A. C. See Dennis, L. M., 23.
- Gorgis, G. Acid Thallium carbonate, 22.
- Grandeau. Poisonous properties, 7.
- Gunning, J. W. Extraction, 11.
- Hapgood, C. W., and A. A. Noyes. Nitrate, 22.
- Hansen, Chr. Ethyl compounds, 12.
- Hartley, W. N. Spectrum, 17, 22.
- Hartwig, F. C. Thallium in union with alcohol radicals, 14.
- Hautfeuille and Troost. Behavior towards hydrogen, 14.
- Heberling. Determination, 9.
- Herepath. Occurrence, 6.
- Heycock and Neville. Thallium-sodium and Thallium-tin alloy, 19; Thallium-cadmium and Thallium-lead alloy, 20; freezing-points of alloys, 22.
- Hodgkinson and French. Action of ammonia on Thallous sulphate, 21.
- Ingleström. Occurrence, 23.
- Jannasch and Aschoff. Separation of chlorine and iodine by Thallous sulphate, 20.
- Joly, A. Thallium hypophosphate, 21.
- Jørgensen, M. Thallous-thallic iodide, 18.
- Kayser, H. Spectrum, 21.
- Klöss, K. Dithionate, 18.
- Knösel, Th. Iodine compounds, 14.
- v. Kobell, F. Occurrence, 12.
- Kosman. In crude zinc, 18.
- Krause, J. Preparation, 14.
- Kreider and Penfield. Separation of minerals by Thallium-silver nitrate, 22.
- Kuhlman, F. Organic salts and determination of Thallium, 5; lead chamber deposits, 7; Thallous fluoride, 8.
- Kulisch. Action of phosphine on Thallium solutions, 17.
- Kupperburg, H. Salicylamid of Thallium, 15.
- Lachaud and Lepierre. Chromate, 20; chloro-chromate, 21.
- Lamy, A. Discovery, occurrence, extraction, 5; toxicological effects, 6; alcoholates, 8; phosphorus compounds, 9; Thallium glass, 10; Thallous oxide a reagent for ozone, 11.
- Lalmy, A., and Des Cloizeau. Chemical and optical study of Thallium, 11, 12.
- Lepierre. Atomic weight, 21.
- v. Lang, V. Crystal form of Thallous sulphate, 7.
- Lepierre and Lachaud. Chromate, 20; chloro-chromate, 21.
- Lescouer. Diacetate, 14.
- Living and Dewar. Spectrum, 16.
- Long, J. H. Optical properties of Thallium tartrate, 19; determination, solubility of Thallous iodide, 20.
- Matthiessen and Vogt. Electrical conductivity, 6.
- Mauro, F. Fluor-oxymolybdate, 21.
- Mayrhofer. See Donath, 17.
- Mellor, S. Thallium-magnesium alloy, 11.
- Meyer, V., and H. Ciltz. Vapor density, 19.
- Miller. Spectrum, 6; crystal form of salts, 9.
- Muir, John. Chlorate, 15.
- Neumann, G. Double salts of Thallium chloride, 18; determination of Thallium, 18.
- Neville and Heycock. Thallium sodium and Thallium in alloy, 19; alloy with cadmium and lead, 20; freezing-points of Thallium alloys, 22.
- Nickles, J. Spectrum, 8; behavior towards mercury, 9.
- Nietzki, R. Preparation of Thallium, 14; determination of Thallium, 15.
- Nilson, L. F. Thallium platino-iodo-nitrite, 15, 16.
- Noyes, A. A., and C. W. Hapgood. Isomorphism of Thallous nitrite and diphenyl-nitrite, 22.
- Oettinger. Molybdate and wolframate, 8.
- Ostwald. Electrical conductivity of Thallous hydrate, 18.
- Otto. Position among the elements, 10.
- Page, A. G. Chlorides, 17.
- Parmentier, F. Thallium silico-molybdate, 16.
- Paulet. Poisonous properties, 7.
- Penfield and Kreider. Separation of minerals by Thallium silver nitrate, 22.
- Penfield and Wells. Tri-iodide, 22.
- Phipson. Determination, 18.
- Piccini, A. Acid oxides, 18.
- Playfair, D. Occurrence, 16.
- Pollé, A. Thallium chrome alum, 16.
- Pratt, J. H. Double halides with alkali metals, 23.

- Preiss, K. and R. Schneider. Thallium sulpho-platinate, 12.  
 Pribram. Tartrate, 21.  
 de la Provostaye. Crystal form of some organic salts, 5.
- Rammelsberg, C. Iodate and double halides 12, isomorphism of Thallium salts with those of univalent elements; hypophosphite, 13; Thallium phosphate and the alkaline phosphates, 12; position among the elements, 12; phosphate, 16, 17; hypophosphate, acid and normal phosphates, 20.
- Ramsay, W. Molecular weight, 19.
- Rathke. Compounds with thiourea, 17.
- Rauter. Action of Thallous oxide on silicon tetrachloride, 20.
- Regnault. Specific heat, 5, amalgams, 10.
- Reid, 9.
- Retgers, J. W. Solubility of Thallous iodide in methyl iodide, 21; Thallous silver nitrate for mineral separations, 21; double nitrate of Thallium with silver, lead, and mercury, 23.
- de la Rive, L. Specific gravity and electrical conductivity, 6.
- Roberts Austin, W. C. Periodic properties, 18.
- Roepper. Occurrence, 6.
- Roozeboom, H. W. B. Thallous chlorate and potassium chlorate, 20.
- Roscoe, H. E. Perchloride, 10; vapor density of Thallous chloride, 15.
- Rosenblatt. Thallous-cobalt nitrate, 18.
- Ross. Boiling-point, 16.
- Salter, T. W. The chromates as pigments, 15.
- Scacchi, E. Crystallographic study of the fluoxymolybdate, 22.
- Schaffner, M. Preparation, 12.
- Scharizer. Crystallographic examination of Thallous tartrate, 22.
- Schneider. Thallium-sodium sulphide, 14; Thallium-potassium sulphide, 19.
- Schönbein. Behavior in the presence of oxygen and hydrogen peroxide, 8.
- Schöne, E. Action of oxygen on Thallium paper, 15.
- Schramm, J. Occurrence and position among the elements, 17.
- Schroder, H. Isomorphism of Thallium and ammonium salts, 14.
- Schroeder, M. Thallium paper as an indicator in titration with sodium sulphide, 16.
- Schöttler. Occurrence, 7; preparation, 8.
- Schucht, L. Electrolytic determination of Thallium, 16; electrical behavior, 17.
- Schumann. Extraction from zinc, 19.
- Seubert and Elten. Sulphate, 20.
- Sorby, H. C. Borax bead test, 11.
- Soret and Duparc. Specific gravity of Thallium alum, 19.
- Spezia, G. Determination of iodine in presence of chlorine by Thallous nitrate, 13.
- Sponholz. Volumetric determination, 20; volumetric determination by bromine water, 21.
- Spring, W. Alum, 17.
- Stavenhagen, A. Arsenite, 23.
- Stolba. Preparation; Thallium alum, 19.
- Strecker. Thallie salts, 9.
- Streit, 10.
- Strong. Occurrence, 8.
- Sulborough. Action of nitrosyl chloride on Thallium, 20.
- Thomsen, J. Heat of neutralization of Thallous hydrate, 12; thermo-chemical study of some Thallium compounds, 14, 16.
- Thorpe, T. E. Isometric relations of Thallium, 14.
- Tommasi, D. Heat of formation of Thallous hydroxide, 17.
- Troost and Hautefeuille. Behavior of Thallium toward hydrogen, 14.
- Ullek, F. Molybdanoxyfluoride, 11.
- Valson, C. A. Refraction of Thallium salts in solution, 13.
- Vogel, Otto. Occurrence; spectrum, 22.
- Vogt and Matthiessen. Electrical conductivity, 6.
- Walker and Carnelley. Dehydration of Thallous oxide, 18.
- Warren, H. N. Thallium in platinum, 18.
- Weber, R. Pyrosulphate, 17.
- Wells and Penfield. Tri-iodide, 23.
- Werner, E. A. Determination in presence of lead, 18.
- Werther, G. Determination as iodide, 8; 9.
- Wilde. Spectrum, 22.
- Willm. Ammonium derivatives of Thallie-chloride, 7, 9.
- Winkler. Reduction of the oxide by magnesium, 20.
- Wöhler. Preparation, Thallous chloride, 10; oxidation in galvanic current, 11; preparation, 13.
- Wyruboff. Compounds of Thallous carbonate, 19.
- Zschiesche. Double sulphides of Thallium with cerium and didymium, 11.

SMITHSONIAN MISCELLANEOUS COLLECTIONS.

1173

INDEX TO THE LITERATURE  
OF  
ZIRCONIUM.

BY

A. C. LANGMUIR, Ph.D.,

AND

CHARLES BASKERVILLE, Ph.D.



WASHINGTON CITY:  
PUBLISHED BY THE SMITHSONIAN INSTITUTION.

1899.

**The Knickerbocker Press, New York**

## LETTER OF TRANSMITTAL.

---

WASHINGTON, MAY 10th, 1899.

The Committee on Indexing Chemical Literature, appointed in 1882 by the American Association for the Advancement of Science, unanimously recommends for publication by the Smithsonian Institution the following :

INDEX TO THE LITERATURE OF ZIRCONIUM,

by A. C. Langmuir, Ph.D., and Charles Baskerville, Ph.D.

H. CARRINGTON BOLTON,  
*Chairman.*

MR. S. P. LANGLEY,  
*Secretary of the Smithsonian Institution.*



## PREFACE.

---

An "Index to the Literature of Zirconium" was begun independently by the two authors. Learning of this, and in order to avoid further unnecessary duplication, it was decided to combine the references then on hand and to divide the remaining labor. The resulting product is thought to contain most of the important references to the element, and is offered to the Committee of the American Association for the Advancement of Science on Indexing Chemical Literature in hopes of its proving of value. The references are brought up to January 1st, 1899.

Besides our private libraries, we have sought references to the subject in the libraries of Columbia, Johns Hopkins, and the North Carolina Universities and the North Carolina Geological Survey. To the gentlemen in charge of these libraries we wish to extend our thanks for their courtesy and co-operation.

A. C. LANGMUIR,  
C. BASKERVILLE.

APRIL, 1899.





# INDEX TO THE LITERATURE OF ZIRCONIUM.

1789-1899

BY A. C. LANGMUIR AND CHARLES BASKERVILLE.

---

- 1789 : 1. KLAPROTH. (Discovery.)  
Klaproth's Beiträge, 1, 203 ; Chem. Ann. (Crell), 1, 7 ; Ann. chim. phys., 1, 238 ; J. des Curieux de la Nature de Berlin.
- 1792 : 2. GMELIN. (Constituents of Zircon.)  
Chem. Ann. (Crell), 1, 99-108.
- 1795 : 3. KLAPROTH. (Occurrence in hyacinth.)  
Klaproth's Beiträge, 1, 227.
- 1797 : 4. VANQUELIN. (Researches.)  
Ann. chim. phys., 22, 179-210, 30, 81 ; J. des Mines, 5, 97.
- 1797 : 5. GUYTON. (Occurrence in hyacinth.)  
Ann. chim. phys., 21, 72-95.
- 1799 : 6. GUYTON. (Behavior on fusion with silica and chalk.)  
Ann. chim. phys., 31, 259.
- 1799 : 7. TROMMSDORFF. (Futile efforts to reduce Zirconium dioxide.)  
Ann. chim. phys., 29, 223.
- 1803 : 8. KLAPROTH. (Analysis Zirconia.)  
Phil. Mag., 17, 237.
- 1807 : 9. KLAPROTH. (Further researches.)  
Gehlen, J., 4, 386-394.
- 1808 : 10. DAVY. (Attempt to decompose Zirconia.)  
Phil. Mag., 32, 203-7.
- 1818 : 11. BERZELIUS. (Comparison with thorium.)  
Afh. Fys. Kemi, 5, 86 ; J. für Chem. (Schweigger), 21, 25.
- 1819 (?) : 18. HARE. (Fusion of Zircon.)  
Am. J. Sci., 2, 292.

- 1820 : 19. PFAFF. (Reactions. Similarity to titanium.)  
J. für Chem. (Schweigger), 28, 102.
- 1820 : 20. CHEVREUL. (Reactions. Separation from iron. Comparison with titanium. Double potassium salt.)  
Ann. chim. phys. [2], 13, 245-9 ; J. für Chem. (Schweigger), 29, 144 ;  
J. de Phys., 90, 170-5 ; Oken. Isis. (1821), 524-26 ; Phil. Mag., 55,  
377-9 ; Trommsdorff, N. J. de Pharm., 5, 214-221.
- 1820 : 21. DUBOIS and SILVEIRA. (Preparation pure Zirconia. Separation from iron.)  
Ann. chim. phys. [2], 14, 110 ; Phil. Mag. [1], 55, 377-9.
- 1822 : 22. STROMEYER. (Presence in eudialith.)  
Berzelius' Jsb., 1, 40.
- 1823 : 23. BERZELIUS. (Silicofluoride.)  
Ann. der Phys. (Pogg.), 1, 23, 197 ; Sv. Vet. Akad. Handl., 1823, 284 ;  
Am. J. Sci., 9, 377.
- 1824 : 24. BERZELIUS. (Researches. Preparation.)  
Sv. Vet. Akad. Handl., 1824, 295 ; Ann. der Phys. (Pogg.), 4, 117-  
45 ; J. für Chem. (Schweigger), 21, 40 ; Berzelius' Jsb., 5, 106-  
12 ; Ann. chim. phys. [2], 26, 43 ; J. de Pharm. [2], 10, 461 ; Mag.  
für Pharm. (Geigers), 12, 295 ; Phil. Mag., 64, 393.
- 1825 : 25. BERZELIUS. (Properties of salts.)  
Ann. chim. phys. [2], 29, 337.
- 1826 : 26. BERZELIUS. (Separation from titanium.)  
Ann. der Phys. (Pogg.), 6, 231-2 ; Berzelius' Jsb., 5, 139.
- 1826 : 27. BERZELIUS. (Sulphotungstate.)  
Ann. der Phys. (Pogg.), 8, 279.
- 1826 : 28. BERZELIUS. (Sulpharsenate.)  
Ann. der Phys. (Pogg.), 7, 24, 144 ; Berzelius' Jsb., 6, 194.
- 1826 : 29. BERZELIUS. (Sulphomolybdate.)  
Ann. der Phys. (Pogg.), 7, 273 ; Berzelius' Jsb., 6, 197.
- 1826 : 30. BERZELIUS. (Atomic weight.)  
Ann. der Phys. (Pogg.), 8, 186.
- 1827 : 31. BERZELIUS. (Atomic weight.)  
Ann. der Phys. (Pogg.), 10, 341.
- 1828 : 32. SPRENGEL. (Presence in plants.)  
J. techn. Chem., 3, 314.
- 1830 : 33. BERTHEMOT. (Bromide.)  
Ann. chim. phys. [2], 44, 393.

- 1831 : 34. **BERZELIUS.** (Vanadinate.)  
Ann. der Phys. (Pogg.), **22**, 58.
- 1832 : 35. **BECQUEREL.** (Electro-chemical decomposition.)  
Ann. chim. phys., **48**, 337-53 ; Mém. de l' Inst. (Paris), **12**, 581-97.
- 1832 : 36. **BERTHIER.** (Preparation.)  
Ann. chim. phys., **50**, 362, 375 ; Ann. Chem. (Liebig), **5**, 246, 258 ;  
Pharm. Centrbl., **3**, 528, 529.
- 1833 : 37. **BERZELIUS.** (Atomic weight.)  
Pharm. Centrbl., **4**, 3.
- 1833 : 38. **TROMMSDORFF.** (Valerianate.)  
Ann. der Phys. (Pogg.), **29**, 159.
- 1834 : 39. **BERZELIUS.** (Atomic weight.)  
Pharm. Centrbl., **5**, 2.
- 1834 : 40. **BERZELIUS.** (Tellurate.)  
Ann. der Phys. (Pogg.), **32**, 594.
- 1834 : 41. **BERZELIUS.** (Tellurite.)  
Ann. der Phys. (Pogg.), **32**, 607.
- 1835 : 42. **BALARD.** (Behavior with bromine.)  
Pharm. Centrbl., **6**, 350.
- 1835 : 43. **BERZELIUS.** (Atomic weight.)  
Pharm. Centrbl., **6**, 2.
- 1835 : 44. **BERZELIUS.** (Pyroracemate.)  
Ann. der Phys. (Pogg.), **36**, 18 ; Pharm. Centrbl., **7**, 42.
- 1840 : 45. **ROSE.** (Precipitation.)  
Ann. der Phys. (Pogg.), **48**, 575 ; Pharm. Centrbl., **11**, 98.
- 1843 : 46. **BERTHIER.** (Separation from iron.)  
Ann. chim. phys. [3], **7**, 74 ; Pharm. Centrbl., **14**, 382.
- 1843 : 47. **SCHEERER.** (Occurrence in wöhlerite. Separation.)  
Ann. der Phys. (Pogg.), **59**, 327-36.
- 1843 : 48. **SCHEERER.** (Preparation pure Zirconia.)  
Ann. der Phys. (Pogg.), **59**, 481 ; Berzelius' Jsb., **24**, 106, 107 ; Pharm.  
Centrbl., **14**, 687.
- 1844 : 49. **HERMANN.** (Preparation. Salts.)  
J. prakt. Chem., **31**, 75-89 ; Pharm. Centrbl., 1844, 193-8 ; Ann.  
Chem. (Liebig), **52**, 240 ; Berzelius' Jsb., **25**, 147.
- 1845 : 50. **SCHEERER.** (Occurrence in Norway.)  
Ann. der Phys. (Pogg.), **65**, 300.

- 1845 : 51. SVANBERG. (A new earth, norium, in Zirkon.)  
Oefvers. K. Vetensk. Akad. Förhandling, 1845, 34 ; Ann. der Phys. (Pogg.), 65, 317-9 ; Berzelius' Jsb., 25, 149 ; Am. J. Sci. [2], 1, 257 ; Chem. Gaz., 1845, 411.
- 1847 : 52. HENNEBERG. (Phosphorescence. Analysis.)  
J. prakt. Chem., 38, 508-10 ; Pharm. Centrbl., 1847, 22, 23.
- 1848 : 53. DAMOUR. (Properties of some salts.)  
Ann. chim. phys. [3], 24, 87-93.
- 1849 : 54. MUSPRATT. (Selenite.)  
J. Chem. Soc. (Lond.), 2, 68.
- 1850 : 55. SJÖGREN. (Analysis. Kataplekt.)  
Ann. der Phys. (Pogg.), 79, 300 ; Chem. Centrbl., 1850, 426 ; Phil. Mag. [3], 37, 235 ; Arch. ph. nat., 14, 154 ; Jsb., 1850, 738.
- 1850 : 56. RIVOT. (Separation from iron.)  
Ann. chim. phys. [3], 30, 188 ; Ann. Chem. (Liebig), 78, 212 ; J. prakt. Chem., 51, 338 ; Chem. Centrbl., 1850, 908 ; Jsb., 1850, 599.
- 1852 : 57. MAZADE. (Occurrence in spring-water.)  
Compt. rend., 34, 952 ; Jsb., 1852, 757.
- 1852 : 58. SJÖGREN. (Peculiarity of Zirconia from kataplekt.)  
Ann. der Phys. (Pogg.), Ergänz., 3, 465 ; J. prakt. Chem., 55, 298 ; Jsb., 1853, 349.
- 1853 : 59. BERLIN. (Researches. Existence of norium denied.)  
J. prakt. Chem., 58, 145-8 ; Am. J. Sci., [2], 16, 412, 413 ; Jsb., 1853, 349, 350.
- 1853 : 60. HENRY. (Occurrence in spring-water.)  
J. de Pharm. [3], 24, 305 ; Jsb., 1853, 674.
- 1853 : 61. FRÉMY. (Sulphide.)  
Ann. chim. phys. [3], 38, 326 ; Compt. rend., 36, 178 ; Chem. Centrbl., 24, 114 ; Jsb., 1853, 328.
- 1854 : 62. BRUSH. (Qualitative test.)  
Am. J. Sci. [2], 18, 415 ; J. prakt. Chem., 62, 6-9 ; J. de Pharm. [3], 26, 154 ; Chem. Centrbl., 25, 495.
- 1854 : 63. DAUBREE. (Artificial production of Zircon.)  
Compt. rend., 39, 153 ; Instit., 1854, 241 ; J. prakt. Chem., 63, 1 ; Phil. Mag. [4], 19, 315 ; Jsb., 1854, 9.
- 1855 : 64. SCHRÖTTER. (Occurrence in zoisite.)  
J. prakt. Chem., 64, 316-9 ; Sitzl. akad., Wien., 14, 352-7 ; Chem. Centrbl., 26, 224 ; Jsb., 1854, 822.

- 1855 : 65. FORBES. (Occurrence in alvit.)  
J. prakt. Chem., 66, 446.
- 1856 : 66. CHANDLER. (Analysis.)  
Inaug. Dissert., Göttingen
- 1857 : 67. WARREN. (Double sulphate with potassium.)  
Ann. der Phys. (Pogg.), 102, 449-53; Jsb., 1857, 158
- 1857 : 68. DEVILLE and TROOST. (Comparison with titanium.)  
Compt. rend., 45, 821.
- 1857 : 69. DEVILLE and TROOST. (Chloride vapor-density.)  
Compt. rend., 45, 821; Ann. chim. phys. [4], 5, 117; Ann. Chem. (Liebig), 105, 217; Phil. Mag. [4], 15, 459; Instit., 1857, 280; Arch. ph. nat. [2], 1, 191; Jsb., 1857, 11, 12.
- 1858 : 70. DEVILLE and CARON. (Artificial preparation of Zircon.)  
Compt. rend., 46, 764; Ann. Chem. (Liebig), 108, 58; Ann. chim. phys. [4], 5, 109; Instit., 1858, 133; Rep. chim. pure, 1, 16; J. prakt. Chem., 74, 157; Jsb., 1858, 2.
- 1859 : 71. MALLET. (Metal. Nitride.)  
Am. J. Sci. [2], 28, 349-54; A. A. A. S. Proc., 1859, 217-20; Ann. Chem. (Liebig), 113, 362; J. de Pharm. [3], 37, 233; Rep. chim. pure, 2, 160; Chem. Centrbl., 1860, 94; Jsb., 1859, 145.
- 1859 : 72. POTYKA. (Opening up Zircon.)  
Jsb., 1859, 277.
- 1859 : 73. DEVILLE. (Vapor density of chloride.)  
Compt. rend., 45, 821; Ann. chim. phys. [3], 58, 281, 282; Ann. der Phys. (Pogg.), 108, 689; Jsb., 1859, 150.
- 1859 : 74. STROHMAYER. (Separation from iron.)  
Ann. Chem. (Liebig), 113, 127; Chem. Centrbl., 1860, 285; Jsb., 1859, 678.
- 1859 : 75. G. ROSE. (Isomorphism with silica.)  
Ann. der Phys. (Pogg.), 107, 602-4; Chem. News, 1, 131; Jsb., 1859, 151.
- 1860 : 76. MARIGNAC. (Fluoride. Researches. Norium.)  
Compt. rend., 50, 952-5; Ann. chim. phys. [3], 60, 257-99; Ann. Chem. (Liebig), 116, 359; Arch. ph. nat. [2], 8, 121-5; Rep. chim. pure, 3, 39; Phil. Mag., [4], 20, 87; J. prakt. Chem., 80, 426; Chem. Centrbl., 1860, 608-5; Jsb., 1860, 134-40.
- 1861 : 77. NORDENSKJÖLD. (Crystalline form of oxide.)  
Ann. der Phys. (Pogg.), 114, 625, 626; J. prakt. Chem., 85, 431; Jsb., 1861, 201.

- 1861 : 79. **DEVILLE.** (Artificial production of Zircon.)  
Compt. rend., **52**, 780; Rep. chim. pure, **3**, 219; Instit., 1861, 141;  
J. prakt. Chem., **86**, 35; Ann. Chem. (Liebig), **120**, 176; Chem.  
News, **5**, 57; Phil. Mag. [4], **21**, 496, 497; Chem. Centrbl., 1862,  
660; Jsb., 1861, 2, 3.
- 1864 : 80. **PISANI.** (Separation from titanium. Determination.)  
Compt. rend., **57**, 298; Ztschr. anal. Chem., **4**, 416, 417; Chem.  
News, **10**, 91, 218; Bull. Soc. chim. (Paris), **2**, 353, 354; Chem.  
Centrbl., 1865, 289-91.
- 1864 : 81. **NYLANDER.** (Existence of two earths in Zirconia.)  
Acta Universitatis Lundensis.
- 1865 : 82. **TROOST.** (Metal.)  
Compt. rend., **61**, 109; Instit., 1865, 226; Bull. Soc. chim. (Paris), **5**,  
212; Arch. ph. nat., **24**, 376; Ann. Chem. (Liebig), **136**, 349; J.  
prakt. Chem., **97**, 171; Chem. News, **12**, 45; Monit. sci. (Quesne-  
ville), **7**, 752; Ztschr. Chem., 1865, 561; Phil. Mag. [4], **30**, 257;  
Am. J. Sci. [2], **50**, 261; Jsb., 1865, 182-4.
- 1865 : 83. **HERMANN.** (Composition of minerals.)  
J. prakt. Chem., **95**, 123; Chem. Centrbl., 1865, 735.
- 1865 : 84. **DEVILLE** and **CARON.** (Artificial production crystallized  
Zirconia.)  
Ann. chim. phys. [4], **5**, 109, 117.
- 1865 : 85. **PHIPSON.** (Preparation of metal.)  
Compt. rend., **61**, 745; J. prakt. Chem., **96**, 447; Bull. Soc. chim.  
(Paris), **5**, 353; Monit. sci. (Quesneville), **7**, 1007; Chem. News, **12**,  
171; Ztschr. Chem., **9**, 30; Chem. Centrbl., 1866, 63; Jsb., 1865,  
184.
- 1865 : 86. **HERMANN.** (Ferrocyanide.)  
J. prakt. Chem., **95**, 127; Jsb., 1865, 709.
- 1865 : 87. **HJORTDAHL.** (Sodium salts.)  
Compt. rend., **61**, 175, 213; Ann. Chem. (Liebig), **137**, 34, 236; Instit.,  
1865, 251; Chem. News, **12**, 58, 69; J. de Pharm. [4], **3**, 148; Bull.  
Soc. chim. (Paris), **5**, 213; Monit. sci. (Quesneville), **7**, 805; Ztschr.  
Chem., 1865, 619; Jsb., 1865, 184-6.
- 1866 : 88. **HERMANN.** (Preparation from Zircon.)  
J. prakt. Chem., **97**, 330; Ztschr. Chem., 1866, 717; Jsb., 1866, 189.
- 1866 : 89. **HERMANN.** (Identity of zirconium and norium.)  
J. prakt. Chem., **97**, 321; Bull. Soc. chim. (Paris), **6**, 383-5; Chem.  
News, **14**, 33; Ztschr. Chem., 1866, 443; Jsb., 1866, 191.

- 1866 : 90. HERMANN. (Separation from earths.)  
J. prakt. Chem., 97, 337; Ztschr. anal. Chem., 5, 381-4; Bull. Soc. chim. (Paris), 6, 335-7; Chem. News, 14, 33; Jsb., 1866, 797-8.
- 1868 : 91. WEBSKY. (Occurrence in kochelite.)  
Jahrb. Miner., 1868, 607; Jsb., 1868, 1013.
- 1868 : 92. FIZEAN. (Expansion of Zircon by heat.)  
Compt. rend., 66, 1005; Ann. der Phys. (Pogg.), 135, 880; Phil. Mag. [4], 36, 31; Jsb., 1868, 52.
- 1868 : 93. CARON. (Zirconia light.)  
Compt. rend., 66, 850, 1040; Ann. chim. phys. [4], 14, 311-5; Monit. sci. (Quesneville), 1868, 400, 899; Ztschr. Chem., 11, 536; Chem. News, 17, 276; Wagner's Jsb., 14, 754, 756; Jsb., 1868, 979.
- 1869 : 94. STREIT and FRANZ. (Separation from titanium.)  
J. prakt. Chem., 108, 75; Ztschr. anal. Chem., 9, 388-90; Ztschr. Chem., 13, 258; Chem. Centrbl., 1870, 98, 319; Jsb., 1869, 915.
- 1869 : 95. TESSIÉ DU MOTAY. (Zirconia light.)  
Wagner's Jsb., 15, 730; Chem. News, 19, 167, 213, 310; Dingl. Polyt. J., 191, 252.
- 1869 : 96. DARKER. (Zirconia light.)  
Chem. News, 19, 499; Dingl. Polyt. J., 194, 519; Wagner's Jsb., 15, 730.
- 1869 : 97. HARRISON. (Zirconia light.)  
Mechan. Mag., 1869, 458; Polyt. Centr., 1869, 1461; Wagner's Jsb., 15, 731.
- 1869 : 98. PAYEN. (Zirconia light.)  
Genie industriel, 1869, 161; Polyt. Centr., 1869, 963; Dingl. Polyt. J., 193, 433; Wagner's Jsb., 15, 752.
- 1869 : 99. VOGT. (Zirconia light.)  
Köln. Zeit., 1869, No. 159; Wagner's Jsb., 15, 750-1.
- 1869 : 100. ———. (Zirconia light.)  
Pharm. J. [2], 11, 81-2.
- 1869 : 101. THALÉN. (Spectrum.)  
Ann. chim. phys. [4], 18, 228.
- 1869 : 102. SORBY. (A new element, jargonium, in Zircon.)  
Lond. Roy. Soc. Proc., 17, 511; Ann. der Phys. (Pogg.), 138, 58-65; Chem. News, 19, 121-3, 142, 181; Ber., 2, 126, 193, 337, 382; Bull. Soc. chim. (Paris), 12, 36; Ztschr. Chem., 1869, 221, 403; Ann. chim. phys. [4], 18, 487; Am. J. Sci. [2], 48, 405; Wagner's Jsb., 15, 1; Jsb., 1869, 261.

- 1869 : 103. FORBES. (Jargonia.)  
Intellectual Observer, 9, 291 ; Chem. News, 19, 277.
- 1869 : 104. SORBY. (Spectrum of mixtures of Zirconium and uranium.)  
Ber., 3, 146 ; Bull. Soc. chim. (Paris), 14, 40 ; Chem. Centrbl., 1870, 369 ; Lond. Roy. Soc. Proc., 18, 197 ; Phil. Mag. [4], 39, 65.
- 1869 : 105. CHURCH. (Idem.)  
Chem. News, 20, 9.
- 1870 : 106. MELLISS. (Metal. Salts.)  
Bull. Soc. chim. (Paris), 14, 204 ; Ber., 4, 57 ; Chem. News, 22, 23 ; Ann. Chem. (Liebig), 153, 238 ; Ztschr. Chem., 1870, 296 ; Jsb., 1870, 328 ; Chem. Centrbl., 1870, 392.
- 1870 : 107. HUGGINS. (Spectrum.)  
Lond. Roy. Soc. Proc., 18, 548.
- 1870 : 108. FRANZ. (Metal. Preparation of pure salts.)  
Ber., 3, 58-60 ; Bull. Soc. chim. (Paris), 13, 507 ; Ztschr. Chem., 1870, 468 ; Chem. Centrbl., 1870, 131 ; Wagner's Jsb., 16, 1, 2 ; Jsb., 1870, 329.
- 1870 : 109. WUNDER. (Isomorphism with titanite and stannic oxides.)  
J. prakt. Chem. [2], 2, 206-12 ; Chem. News, 22, 215 ; Ztschr. Chem., 1870, 286 ; Jsb. Min., 1870, 1000 ; Gazz. chim. ital., 1, 527 ; Chem. Centrbl., 1870, 663.
- 1871 : 110. MENDELÉJEFF. (Fluoride.)  
Ber., 4, 933.
- 1871 : 111. RATH. (Occurrence in diorite.)  
Ann. der Phys. (Pogg.), 144, 250.
- 1871 : 112. KNOP. (Artificial production of crystals.)  
Ann. Chem. (Liebig), 157, 363 ; 159, 36 ; Bull. Soc. chim. (Paris), 15, 190 ; Ztschr. Chem., 1871, 397 ; J. Chem. Soc. (Lond.), 24, 805 ; Jsb., 1871, 322.
- 1871 : 113. TROOST and HAUTEFEUILLE. (Oxychloride.)  
J. prakt. Chem. [2], 4, 298 ; Compt. rend., 73, 563 ; Instit., 1871, 49 ; Bull. Soc. chim. (Paris), 16, 240 ; J. Chem. Soc. (Lond.), 24, 1000 ; Gazz. chim. ital., 1, 628 ; Jsb., 1871, 293.
- 1871 : 114. TROOST and HAUTEFEUILLE. (Spectrum.)  
Compt. rend., 73, 620 ; Instit., 1871, 77 ; Arch. ph. nat., 42, 178 ; Bull. Soc. chim. (Paris), 16, 229 ; Ztschr. Chem., 1871, 465 ; J. Chem. Soc. (Lond.), 24, 1147 ; Jsb., 1871, 169.
- 1871 : 115. RAMMELSBERG. (Separation from niobic and tantalic acids.)  
J. Chem. Soc. (Lond.), 25, 195 ; Ber., 4, 875.



- 1872 : 116. RAMMELSBERG. (Action of heat on amorphous oxide.)  
Ber. 5, 1006.
- 1872 : 117. RAMMELSBERG. (Sulphate.)  
Ber., 5, 1005.
- 1872 : 118. TROOST and HAUTEFEUILLE. (Action of silicon chloride on oxide.)  
Compt. rend., 75, 1819; Ber., 6, 34; Gazz. chim. ital., 2, 27; Jsb., 1872, 226.
- 1872 : 119. NORDENSKJÖLD. (Occurrence in nohlite.)  
Bull. Soc. chim. (Paris), 18, 178.
- 1873 : 120. MALLARD. (Behavior of oxide with sodium carbonate.)  
Compt. rend., 75, 472; Gazz. chim. ital., 3, 84.
- 1873 : 121. HANNAY. (Zirconia.)  
J. Chem. Soc. (Lond.), 26, 703-10; Chem. News, 27, 232; Ber., 6, 571; Am. Chemist, 4, 194; Jsb. rein. Chem., 1, 73; Gazz. chim. ital., 3, 468.
- 1873 : 122. MIXTER and DANA. (Specific heat.)  
Ann. Chem. (Liebig), 169, 388; Chem. Centrbl., 1873, 721; Bull. Soc. chim. (Paris), 21, 68; Jsb. rein. Chem., 1, 73; J. Chem. Soc. (Lond.), 27, 118; Am. J. Sci. [3], 7, 506-7; Gazz. chim. ital., 3, 577; 5, 107; Jsb., 1873, 58.
- 1873 : 123. PATKULL. (Compounds: Hydroxide, oxychloride, double chlorides, sulphate, arsenate, and ortho-phosphate.)  
Oefvers. Sv. Vetensk. Akad. Forh., 1873, 22; Ber., 1873, 1467; Jsb. rein. Chem., 1, 73; Bull. Soc. chim. (Paris), 20, 65; Chem. News, 28, 45; J. Chem. Soc. (Lond.), 26, 1105; Chem. Centrbl., 1873, 594; Gazz. chim. ital., 3, 484; Am. Chemist, 4, 393; Jsb., 1873, 263.
- 1873 : 124. JANNETTAZ. (Propagation of heat by Zirconia.)  
Ann. chim. phys. [4], 29, 33.
- 1874 : 125. TROOST and HAUTEFEUILLE. (Spectrum.)  
Compt. rend., 73, 620; Ztschr. anal. Chem., 13, 313-4.
- 1875 : 126. ENDEMANN. (Soluble basic salts.)  
Am. Chemist, 5, 326-7; Bull. Soc. chim. (Paris), 24, 466; J. prakt. Chem. [2], 11, 219; Jsb. rein. Chem., 3, 84; J. Chem. Soc. (Lond.), 28, 1162; Gazz. chim. ital., 6, 428; Chem. Centrbl., 1875, 339; Jsb., 1875, 219.
- 1875 : 127. NILSON. (Selenites.)  
"Researches on Salts of Selenious Acid," Upsala, 1875.
- 1876 : 128. NILSON. (Platinate.)  
Ber., 9, 1143; Bull. Soc. chim., 27, 209; Jsb., 1876, 294.

- 1876 : 129. **HORNBERGER.** (Comparison with silicon. Preparation pure chloride. Alkaline tartrates. Cyanogen compounds.)  
Am. Chem. (Liebig), 181, 232 ; Bull. Soc. chim. (Paris), 26, 493 ; Jsb. rein. Chem., 4, 90 ; J. de Pharm. [4], 25, 154 ; J. Chem. Soc. (Lond.), 30, 275 ; Chem. News, 33, 261 ; Gazz. chim. ital., 7, 166, 232 ; Chem. Centrbl., 1876, 435 ; Jsb., 1876, 240.
- 1877 : 130. **PHILIPP.** (Technology.)  
Jsb., 1877, 1121.
- 1877 : 131. **DRAPER.** (Zirconia cylinders for oxyhydrogen light.)  
Am. J. Sci. [3], 14, 208 ; Chem. Centrbl., 1877, 673.
- 1877 : 132. **VINCENT.** (Behavior towards trimethylaniline.)  
Bull. Soc. chim. (Paris), 27, 194 ; Chem. Centrbl., 1878, 263.
- 1878 : 133. **PHILIPP.** (Zirconia light.)  
Monit. sci. (Quesneville), 20, 481.
- 1878 : 134. **MALLET.** (Occurrence in sipylite.)  
Am. J. Sci. [3], 14, 397 ; Chem. Centrbl., 1878, 7.
- 1879 : 135. **FRIEDEL and CRAFTS.** (Action of chloride on organic compounds.)  
Bull. Soc. chim. (Paris), 31, 531 ; Ber., 12, 373.
- 1879 : 136. **PAYKULL.** (Compounds.)  
Ber. 12, 1719.
- 1880 : 137. **ÄNGSTRÖM.** (Oxide, diamagnetic.)  
Jsb., 1880, 338 ; Dammer II., 1, 619.
- 1880 : 138. **SORET.** (Spectrum.)  
Arch. ph. nat. [3], 4, 261 ; Jsb., 1880, 214.
- 1880 : 139. **NILSON and PETTERSSON.** (Specific heat.)  
Compt. rend., 91, 232 ; Ber., 13, 1461 ; Jsb., 1880, 237.
- 1880 : 140. **VINCENT.** (Behavior towards dimethylaniline.)  
Bull. Soc. chim., Paris, 33, 156-8 ; Ztschr. anal. Chem., 19, 479 ; Chem. Centrbl., 1880, 279.
- 1881 : 141. **CLARKE.** (Atomic weight.)  
Phil. Mag. [5], 12, 101 ; Am. Chem. J., 3, 263 ; Jsb., 1881, 7.
- 1881 : 142. **CROOKES.** (Phosphorescent spectrum.)  
Bakerian Lecture, May 31, 1883, Lond. Roy. Soc. Proc., 32, 206 ; Ann. chim. phys. [5], 23, 555 ; Compt. rend., 92, 1281 ; Chem. News, 43, 237 ; Jsb., 1881, 131.
- 1882 : 143. **WELLER.** (Action of hydrogen peroxide on.)  
Ber., 14, 2592 ; Jsb., 1882, 1292.

- 1882 : 144. CLASSEN. (Electrolytic separation.)  
Ber. 14, 2783; Zeit. anal. Chem., 22, 421; Chem. Centrbl., 1882, 233.
- 1882 : 145. LEVY and BOLRGEAIS (Microchemical reaction.)  
Compt. rend., 94, 812; Chem. News, 45, 240; Jsb., 1882, 1527.
- 1882 : 146. BOISBAUDRAN. (Separation from gallium.)  
Compt. rend., 94, 1154; Chem. News, 45, 207; Jsb., 1882, 1206.
- 1883 : 147. DONATH and MAYRHOFER. (Affinity.)  
Ber., 16, 1588; Jsb., 1883, 26.
- 1884 : 148. CLARKE. (Atomic weight.)  
Chem. Ztg., 8, 930.
- 1884 : 149. STOLBA. (Opening up Zircons.)  
Chem. News, 49, 174; J. Chem. Soc., 46, 821; Jsb., 1884, 1594.
- 1885 : 150. GROSHAUS. (Density.)  
Rev. Trav. chim. pays bas., 4, 236; Jsb., 1885, 53.
- 1885 : 151. CROOKES. (Spectrum when samarium is present.)  
Compt. rend., 100, 1380; Lond. Roy. Soc. Proc., 38, 414; Chem. News, 51, 301; Jsb., 1885, 332.
- 1885 : 152. DEMARÇAY. (Separation from titanium.)  
Compt. rend., 100, 740-742; Rep. anal. Chem., 1885, 186; Chem. Centrbl., 56, 283; Jsb., 1885, 1929.
- 1885 : 153. CLÉVE. (Peroxide.)  
Bull. Soc. chim. (Paris), 43, 57; Ztschr. anal. Chem., 28, 699; Jsb., 1885, 492.
- 1885 : 154. LINNEMANN. (Qualitative composition. Opening up Zircons.)  
Monatsh. Chem., 6, 335-47; Chem. Ztg., 9, 1244; Ber., 18, c, 459, 460; J. Chem. Soc., 48, 1042; Chem. News, 52, 233, 240; Chem. Centrbl., 56, 666, 667.
- 1885 : 155. LINNEMANN. (Absorption spectra of Zircons.)  
Monatsh. Chem., 6, 531, 536; Ber., 18, c, 605; J. Chem. Soc., 48, 1173; Chem. News, 52, 220; Chem. Centrbl., 56, 207; Jsb., 1885, 2271.
- 1886 : 156. BAILEY. (Separation and estimation by hydrogen peroxide.)  
J. Chem. Soc., 49, 149-152; Chem. News, 53, 55, 260; Ann. Chem. (Liebig), 232, 352; Ber., 19, c, 319; Chem. Ztg., 10, 1, 148, 677; Pharm. J. [3], 16, 1022; Chem. Centrbl., 57, 172, 451.

- 1886 : 157. BAILEY. (Separation and estimation by hydrogen peroxide.)  
J. Chem. Soc. (Lond.), 49, 481-6 ; Chem. News, 53, 160 ; Am. J. Sci., 26, 470 ; Ztschr. anal. Chem., 28, 699 ; Ann. Chem. (Liebig), 232, 352 ; Ber., 19, c, 881 ; Chem. Centrbl., 57, 682 ; Jsb., 1886, 1942.
- 1886 : 158. LINNEMANN. (Zirconia light.)  
Monatsh. Chem., 6, 899-908 ; J. Chem. Soc. (Lond.), 50, 417 ; Chem. Centrbl., 57, 263, 264 ; Wagner's Jsb., 32, 381-4 ; Jsb., 1885, 2167.
- 1886 : 159. HAUTEFEUILLE and MARGOTTET. (Phosphate.)  
Compt. rend., 102, 1017-1019 ; Ber., 19, c, 387 ; J. Chem. Soc. (Lond.), 50, 670 ; Chem. News, 53, 252 ; Chem. Centrbl., 57, 468 ; Jsb., 1886, 447.
- 1886 : 160. VAN DER PLAATS. (Atomic weight.)  
Ann. chim. phys. [6], 7, 501 ; Zeitschr. anal. Chem., 26, 276.
- 1886 : 161. TROOST and OUVARD. (Double potassium phosphate.)  
Compt. rend., 102, 1422-7 ; Ber., 19, c, 659 ; J. Chem. Soc., 50, 853 ; Chem. Centrbl., 57, 594 ; Jsb., 1886, 453, 454.
- 1887 : 162. MEYER and WILKINS. (Action of carbon tetrachloride on oxide.)  
Ber., 20, 683 ; Jsb., 1887, 379.
- 1887 : 163. DITTE. (Behavior towards sulphuric acid. Selenate.)  
Compt. rend., 104, 172 ; Jsb., 1887 [1], 547, 549 ; Dammer. II, 1, 622.
- 1887 : 164. RAMMELSBERG. (Separation from thorium, cerium, etc.)  
Sitzber. Akad. Wissin., Berlin, 1886, 441 ; Ber., 20, c, 413.
- 1887 : 165. PICCINI. (Action of hydrogen peroxide.)  
Gazz. chim. ital., 17, 486 ; Jsb., 1887, 551.
- 1887 : 166. DEMARÇAY. (Action of carbon tetrachloride on Zirconia.)  
Compt. rend., 104, 113 ; Ber., 20, c, 96 ; Chem. Centrbl., 58, 214 ; Jsb., 1887, 380.
- 1887 : 167. WILLGERODT. (Action as a chloridizing agent.)  
J. prakt. Chem. [2], 35, 391 ; Ber., 20, c, 312 ; Chem. Centrbl., 58, 720 ; Jsb., 1887, 618.
- 1887 : 168. WEIBULL. (Crystalline forms of Zirconyl chloride and bromide ; also sulphate.)  
Ber., 20, a, 1894-6 ; J. Chem. Soc. (Lond.), 52, 778 ; Chem. Centrbl., 58, 778 ; Jsb., 1887, 553.

- 1887 : 169. TROOST and OUVRARD. (Double sodium phosphate. Comparison with thorium.)  
Compt. rend., 105, 30-4; Ber., 20, c, 534; J. Chem. Soc. (Lond.), 52, 1017; Chem. News, 56, 57; Chem. Centrbl., 58, 1015; Jsb., 1887, 554-6.
- 1887 : 170. HINSBERG. (Attempt to prepare Zirconium ethyl. Iodide.)  
Ann. Chem. (Liebig), 239, 253-8; Ber., 20, c, 413; J. Chem. Soc. (Lond.), 52, 890; Chem. News, 56, 219; Chem. Centrbl., 58, 1016; Jsb., 1887, 553.
- 1887 : 171. TROOST and OUVRARD. (Zircon not isomorphous with thorium silicate.)  
Compt. rend., 105, 255; Chem. Centrbl., 58, 1098; Jsb., 1887, 556; Ber., 20, c, 534.
- 1887 : 172. WELSBACH. (Welsbach burners.)  
Ber., 20, c, 406; Chem. News, 55, 192; Chem. Centrbl., 1887, 1125; Jsb., 1887, 2670; German Patent, 39, 162.
- 1888 : 173. HAUTEFEUILLE and PERREY. (Artificial preparation of Zircon.)  
Compt. rend., 107, 1000, 1001; Ber., 22, c, 94; J. Chem. Soc. (Lond.), 56, 355; Chem. News, 59, 11; Monit. sci. (Quesneville), 33, 199; Chem. Centrbl., 1889 [1], 127; Jsb., 1888, 638.
- 1888 : 174. BLÖMSTRAND. (Constitution of silicates containing Zirconium.)  
Ztschr. Kryst., 15, 83, 84; Chem. Centrbl., 1889 [1], 821; Jsb., 1888, 637.
- 1888 : 175. KEEPORT. (Application in gold metallurgy.)  
Ber., 21, c, 458; Wagner's Jsb., 34, 360; Jsb., 1888, 2650; German Patent, 43, 231.
- 1888 : 176. CARNELLEY and WALKER. (Action of heat on hydrate.)  
J. Chem. Soc. (Lond.), 53, 68, 82; Ber., 21, 131.
- 1888 : 177. SCHMIDT and HAENSCH. (Emissive power of Linnemann's light.)  
Ann. der Phys. (Pogg.), Berbl., 12, 244; Jsb., 1888, 2838.
- 1889 : 178. RIÓRDÁN. (Preparation from eudialyte.)  
Chem. Centrbl., 1889, 533.
- 1889 : 179. WELSBACH. (Preparation of pure nitrate.)  
Chem. Ztg., 13 [2], 1192; American Patent, 409, 653.
- 1889 : 180. STOLBA. (Opening up Zircon.)  
Listy chemické, 13, 117, 118; Chem. Centrbl., 1889, 1, 297.

- 1889 : 181. DAVIS. (Separation from aluminium.)  
Amer. Chem. J., 11, 26-9 ; Ztschr. anal. Chem., 29, 454, 455 ; Ber., 22, c, 300 ; J. Chem. Soc. (Lond.), 56, 551 ; Chem. News, 59, 100, 101 ; Chem. Centrbl., 60, 1, 454 ; Jsb., 1889, 2388.
- 1889 : 182. DAY. (Production in United States.)  
Mineral Resources, U. S. 6th report ; J. Soc. Chem., Ind., 8, 591.
- 1889 : 183. BAILEY. (Atomic weight. Oxychloride. Peroxide.)  
Lond. Roy. Soc. Proc., 46, 74-87 ; Chem. News, 60, 6-8, 17, 18, 32 ; J. Chem. Soc. (Lond.), 58, 705 ; Ztschr. anal. Chem., 29, 743-7 ; Nature, 36, 568 ; Ber., 22, c, 655, 666 ; Ztschr. physikal Chem., 4, 494 ; Chem. Centrbl., 1889 [2], 311, 312 ; Jsb., 1889, 113-6 ; Brit. Assn. Trans., 1887, 636.
- 1890 : 184. HAUTEFEUILLE and PERREY. (Action of hydrochloric acid gas on oxide.)  
Compt. rend., 110, 1038 ; Ber., 23, c, 428 ; J. Chem. Soc. (Lond.), 58, 1071.
- 1890 : 185. WARREN. (Precipitation by magnesium.)  
Chem. News, 61, 183 ; Ber., 23, c, 560 ; Jsb., 1890, 42.
- 1890 : 186. HIRSCHWALD. (Solubility in microcosmic salt bead.)  
J. prakt. Chem. [2], 41, 360 ; Jsb., 1890, 2421.
- 1890 : 187. WINKLER. (Reduction of oxide by magnesium.)  
Ber., 23, b, 2664-8 ; J. Chem. Soc. (Lond.), 58, 1375 ; Chem. Centrbl., 1890 [2], 644, 645 ; Jsb., 1890, 432.
- 1890 : 188. IMRAY. (Preparation from ores.)  
J. Soc. Chem. Ind., 9, 941 ; English Patent, 16, 555.
- 1890 : 189. KOCHS. (Zirconia light.)  
Dingl. Polyt. J., 278, 235-40 ; J. Soc. Chem. Ind., 10, 37 ; Wagner's Jsb., 37, 62 ; Eng. and Mining J., 51, 466 ; Jsb., 1890, 2850.
- 1891 : 190. VENABLE. (Preparation of pure chloride.)  
J. anal. Chem., 5, 551 ; J. El. Mitchell Sc. Soc., 8, 20 ; Chem. Ztg., 15, 328 ; J. Chem. Soc. (Lond.), 62, 412 ; Chem. News, 64, 315, 316 ; Chem. Centrbl., 1891 [1], 149 ; Jsb., 1891, 575.
- 1891 : 191. DROSSBACH. (Zirconia pencils.)  
Chem. Ztg., 15 [1], 328 ; Chem. Centrbl., 1891 [1], 772, 773.
- 1891 : 192. BEHRENS. (Microchemical reaction.)  
Ztschr. anal. Chem., 30, 156 ; Chem. News, 64, 124.
- 1891 : 193. MOREHEAD. (Analysis of Zircon.)  
J. El. Mitchell Sc. Soc., 8, 24.

- 1891 : 194. WINKLER. (Action of magnesium on oxide. Hydride.)  
Ber., 24, a, 888; J. Chem. Soc. (Lond.), 60, 802; Bull. Soc. chim. (Paris), [3], 6, 173; Chem. Centrbl., 1891 [1], 912; Jsb., 1891, 499.
- 1891 : 195. VENABLE. (Occurrence.)  
J. El. Mitchell Sc. Soc., 8, 74.
- 1891 : 196. OUVARD. (Alkaline Zirconates.)  
Compt. rend., 112, 1444-6; Ber., 24, c, 604; J. Chem. Soc. (Lond.), 60, 1431; Monit. sci. (Quesneville), 37, 868; Chem. News, 64, 26; Chem. Centrbl., 62, 2248; Jsb., 1891, 576.
- 1891 : 197. OUVARD. (Alkaline earth Zirconates.)  
Compt. rend., 113, 80-2; Monit. sci. (Quesneville), 37, 976; J. Chem. Soc. (Lond.), 60, 1431; Chem. News, 64, 61; Chem. Centrbl., 1891 [2], 415; R. Meyer's Jahrb., 1, 89.
- 1891 : 198. WALLER. (Zirconium light.)  
Eng. and Mining J., 51, 520.
- 1892 : 199. CHRUSTSCHOFF. (Artificial production Zircon.)  
Jahrb. Mineralogie, 1892 [2], 232-6; Chem. Centrbl., 1893 [1], 123; [2], 880, 881.
- 1893 : 200. BASKERVILLE. (Comparison of methods of analysis.)  
Doctorate Dissertation, J. El. Mitchell Sc. Soc., 10, 45-68.
- 1893 : 201. MCKEAN. (Color of light emitted.)  
Zeit. Ver. Deutschr. Ing., 1893, 310; R. Meyer's Jahrb., 3, 335.
- 1893 : 202. VENABLE. (Examination of chlorides.)  
J. El. Mitchell Sc. Soc., 10, 79-87.
- 1893 : 203. MOISSAN. (Volatilization in electric furnace.)  
Compt. rend., 116, 1222-4; J. Chem. Soc. (Lond.), 64 [2], 532; Chem. News, 68, 16; Ber., 26, d, 482; Ztschr. anorg. Chem., 4, 473; Bull. Soc. chim. (Paris), [3], 11, 863-4; Chem. Centrbl., 1893 [2], 190; R. Meyer's Jahrb., 3, 71.
- 1893 : 204. TROOST. (Preparation of metal in electric furnace.)  
Compt. rend., 116, 1227-30; J. Chem. Soc. (Lond.), 64 [2], 473; Bull. Soc. chim. (Paris), [3], 9, 792; Ber., 26, d, 483; Ztschr. anorg. Chem., 4, 474; R. Meyer's Jahrb., 3, 75; Chem. Centrbl., 1893 [2], 191.
- 1893 : 205. TROOST. (Preparation of oxide in electric furnace.)  
Compt. rend., 116, 1428, 1429; J. Chem. Soc. (Lond.), 64 [2], 532; Chem. News, 68, 28; Ztschr. anorg. Chem., 5, 241; Bull. Soc. chim. (Paris), [3], 9, 794; Ber., 26, d, 669; Chem. Centrbl., 1893 [2], 356.

## 1893 : 206. PÉCHARD. (Molybdate.)

Compt. rend., 117, 788-90; J. Chem. Soc. (Lond.), 66 [2], 96; Bull. Soc. chim. (Paris), [3], 11, 184; Ztschr. anorg. Chem., 6, 200; Ber., 27, d, 2; Chem. Centrbl., 1893 [1], 140.

## 1894 : 207. READ. (Behavior of oxide at high temperatures.)

J. Chem. Soc. (Lond.), 65, 314.

## 1894 : 208. WITT. (Emissive power in Welsbach burner.)

Wagner's Jsb., 40, 540.

## 1894 : 209. BASKERVILLE. (Separation by sulphur dioxide.)

J. Amer. Chem. Soc., 16, 475, 476; J. Chem. Soc. (Lond.), 66 [2], 401; Chem. News, 70, 57; Ztschr. anorg. Chem., 7, 434; Bull. Soc. chim. (Paris), [3], 12, 1283; Chem. Centrbl., 1894 [2], 299; R. Meyer's Jahrb., 4, 98; J. El. Mitchell Sc. Soc., 11, 85-7.

## 1894 : 210. VENABLE. (Chlorides. Separation from silicon and iron.)

J. Amer. Chem. Soc., 16, 469-75; Chem. News, 70, 217-9; J. Chem. Soc. (Lond.), 66 [2], 385; Chem. Centrbl., 1894 [2], 299; R. Meyer's Jahrb., 4, 98.

## 1895 : 211. SMITH and HARRIS. (Action of phosphorus pentachloride on oxide.)

J. Amer. Chem. Soc., 17, 654-6; J. Chem. Soc. (Lond.), 70 [2], 179; Bull. Soc. chim. (Paris), [3], 16, 225; Chem. Centrbl., 1895 [2], 590.

## 1895 : 212. VENABLE and BASKERVILLE. (Sulphites.)

J. Amer. Chem. Soc., 17, 448-53; J. Chem. Soc. (Lond.), 70 [2], 527; J. El. Mitchell Sc. Soc., 12, 16-22; Bull. Soc. chim. (Paris), [3], 14, 107; Chem. Centrbl., 1895 [2], 15.

## 1895 : 213. VENABLE. (Chlorides.)

J. Amer. Chem. Soc., 17, 842, 843; J. El. Mitchell Sc. Soc., 12, 22, 23; J. Chem. Soc. (Lond.), 70 [2], 478; Chem. News, 73, 25; Chem. Centrbl., 1896 [1], 15.

## 1896 : 214. LARSSON. (Niobate.)

Ztschr. anorg. Chem., 12, 203; Ber., 29, d, 635; Chem. Centrbl., 1896 [2], 235; J. Chem. Soc., 70 [2], 564.

## 1896 : 215. BARNES. (Use as a mordant.)

J. Soc. Chem. Ind., 15, 420; Ber., 29, d, 1097.

## 1896 : 216. PICCINI. (Action of hydrogen peroxide on fluoride.)

Ztschr. anorg. Chem., 10, 438; Ber., 29, d, 129.

## 1896 : 217. LANDOLT. (Zirconia light.)

Ztschr. anal. Chem., 35, 714.



- 1896 : 218. PHIPSON. (Abundant source in Norwegian granite.)  
Chem. News, 73, 145; Bull. Soc. chim. (Paris), [3], 16, 1756; J. Chem. Soc., 70 [2], 422; Chem. Centrbl., 1896 [1], 1053.
- 1896 : 219. MOISSAN and LENGFELD. (Carbide.)  
Compt. rend., 122, 651-4; Bull. Soc. chim. (Paris), [3], 15, 1275-8; Monit. sci. (Quesneville), 46, 393; Ber., 29, d, 343; Chem. Centrbl., 1896 [1], 1887; R. Meyer's Jahrb., 6, 78.
- 1896 : 220. HALLOPEAN. (Tungstates.)  
Bull. Soc. chim. (Paris), [3], 15, 917-23; Compt. rend., 122, 1419-22; Chem. News, 74, 12; Monit. sci. (Quesneville), 47, 636; J. Chem. Soc. (Lond.), 70 [2], 607; Ber., 29, d, 582; Chem. Centrbl., 1896 [2], 775.
- 1896 : 221. VENABLE and T. CLARKE. (Various Zirconates of Alkalies and alkaline earths.)  
J. Amer. Chem. Soc., 18, 434-44; J. El. Mitchell Sc. Soc., 13, 1-13; Chem. News, 74, 42-4, 54, 55; J. Chem. Soc. (Lond.), 70 [2], 653; Ber., 29, d, 1094; Chem. Centrbl., 1896 [2], 11, 12.
- 1896 : 222. ST. JOHN. (Illuminating power of oxide.)  
Ann. der Phys. (Wied.), 56, 433; Wagner's Jsb., 42, 72
- 1896 : 223. TRAUBE. (Opening up Zircons.)  
Jahrb. Mineral., 10, 470-6; Chem. Centrbl., 1896 [2], 130.
- 1896 : 224. MÜLLER-JACOBS. (Tannate.)  
American Patent, 558, 197; Ber., 29, d, 448.
- 1896 : 225. MOISSAN. (Carbide.)  
Compt. rend., 122, 1462; Ber., 29, d, 614; Chem. News, 73, 175; J. Chem. Soc. (Lond.), 70 [2], 428; R. Meyer's Jahrb., 6, 78.
- 1896 : 226. WELLS and FOOTE. (Double fluorides.)  
Ztschr. anorg. Chem., 10, 434-7; Ber., 29, d, 128; J. Chem. Soc. (Lond.), 70 [2], 179; Chem. Centrbl., 1896 [1], 239; R. Meyer's Jahrb., 7, 86.
- 1896 : 227. DENNIS and SPENCER. (Tetraiodide.)  
J. Amer. Chem. Soc., 18, 673-9; Chem. News, 74, 102-4; Ber., 29, d, 1097; Chem. Centrbl., 1896 [2], 651, 652; R. Meyer's Jahrb., 6, 82.
- 1896 : 228. FRESSENIUS and HINTZ. (Determination in thorium nitrate.)  
Ztschr. anal. Chem., 35, 535.
- 1896 : 229. GLASER. (Determination in monazite.)  
J. Amer. Chem. Soc., 18, 782-93; Chem. News, 75, 145-7, 157; Chem. Ztg., 20, 612-14; Chem. Centrbl., 1896 [2], 803.

- 1897 : 230. VENABLE and BASKERVILLE. (Oxalates.)  
J. Amer. Chem. Soc., 19, 12-18; J. El. Mitchell Sc. Soc., 14, 4-12;  
Chem. News, 75, 113-15; Chem. Centrbl., 1897 [1], 905; R. Meyer's  
Jahrb., 7, 86; J. Chem. Soc. (Lond.), 78, a [II], 295.
- 1897 : 231. DELAFONTAINE. (Separation from thorium.)  
Chem. News, 75, 230; Chem. Centrbl., 1897 [2], 70.
- 1897 : 232. WELLS and FOOTE. (Double fluorides.)  
Am. J. Sci. [4], 3, 466-71; Chem. News, 76, 44-6; Chem. Centrbl.,  
1897 [2], 94, 95.
- 1898 : 233. TRUCHOT. (Occurrence.)  
Revue générale des Sciences; Chem. News, 77, 146.
- 1898 : 234. VENABLE. (Atomic weight.)  
J. Amer. Chem. Soc., 20, 118-28; Chem. News, 77, 221-3; J. El.  
Mitchell Sc. Soc., 14, 27-46; Chem. Centrbl., 1898 [1], 708, 709; J.  
Chem. Soc. (Lond.), 78, a [II], 438.
- 1898 : 235. VENABLE and BELDEN. (Properties of dioxide.)  
J. Amer. Chem. Soc., 20, 273-6; Chem. Centrbl., 1898 [1], 1095;  
J. Chem. Soc. (Lond.), 78, a [II], 597.
- 1898 : 236. VENABLE and BASKERVILLE. (Oxyhalides.)  
J. Amer. Chem. Soc., 20, 321-9; J. El. Mitchell Sc. Soc., 14, 12-31;  
Chem. Centrbl., 1898 [II], 87; J. Chem. Soc. (Lond.), 78, a [II],  
596; Ztschr. angew. chem., 1898, 559 (obs.).
- 1898 : 237. BOUDONARD. (Determination in monazit.)  
Bull. Soc. chim. (Paris), [3], 19, 10-13; Chem. Centrbl., 1898 [1], 435.
- 1898 : 238. POSSETTO. (Qualitative analysis.)  
Giorn. Farm. Chim., 48, 49-54; Chem. Centrbl., 1898 [1], 634.
- 1898 : 239. HABER. (Behavior toward chromates and some organic  
acids. Formate.)  
Monatsh. Chem., 18, 687-99; Chem. Centrbl., 1898 [1], 657; J. Chem.  
Soc. (Lond.), 78, a [II], 295.
- 1898 : 240. HINTZ. (Influence of dioxide on emissive power of in-  
candescent gas mantels.)  
J. Chem. Soc. (Lond.), 78, a [II], 587.
- 1898 : 241. DE GRAMONT. (Detection, spectroscopically.)  
J. Chem. Soc. (Lond.), 78, a [II], 636.
- 1898 : 242. HOLMQUIST. (Niobate.)  
J. Chem. Soc. (Lond.), 78, a [II], 388.
- 1898 : 243. P. H. WALKER. (Separation from iron and uranium.)  
J. Amer. Chem. Soc., 20, 514; J. Chem. Soc. (Lond.), 78, a [II], 540.

- 1898 : 244. MATTHEWS. (Derivatives of the tetrachloride.)  
J. Amer. Chem. Soc., 20, 815.
- 1898 : 245. MATTHEWS. (Derivatives of the tetrabromide.)  
J. Amer. Chem. Soc., 20, 839.
- 1898 : 246. MATTHEWS. (Preparation of nitrides.)  
J. Amer. Chem. Soc., 20, 843.
- 1898 : 247. MATTHEWS. (Separation of iron from Zirconium.)  
J. Amer. Chem. Soc., 20, 846.
- 1898 : 248. LANDOLT, OSTWALD, and SEUBERT. (Atomic weight.)  
Ber., 31 [3], 2762.

# AUTHOR INDEX.

*Figures refer to the numbers in the second column.*

- Ångström, 137.  
 Bailey, 156, 157, 183.  
 Ballard, 42.  
 Barnes, 215.  
 Baskerville, 200, 209, 212, 230, 236.  
 Becquerel, 35.  
 Behrens, 192.  
 Belden, 235.  
 Berlin, 59.  
 Berthemot, 33.  
 Berthier, 36, 46.  
 Berzelius, 11, 23-31, 34, 37, 39-41, 43, 44.  
 Blömstrand, 174.  
 Boisbaudran, 146.  
 Boudonard, 237.  
 Bourgeois, 145.  
 Brush, 62.  
 Carnelley, 176.  
 Caron, 70, 84, 93.  
 Chandler, 66.  
 Chevreul, 20.  
 Chrustschoff, 199.  
 Church, 105.  
 Clarke, 141, 148.  
 Clarke, T., 221.  
 Classen, 144.  
 Clève, 153.  
 Crafts, 135.  
 Crookes, 142, 151.  
 Damour, 53.  
 Dana, 122.  
 Darker, 96.  
 Daubree, 63.  
 Davis, 181.  
 Davy, 10.  
 Day, 182.  
 de Gramont, 241.  
 Delafontaine, 231.  
 Demarçay, 152, 166.  
 Dennis, 227.  
 Deville, 68-70, 73, 79, 84.  
 Ditte, 163.  
 Donath, 147.  
 Draper, 131.  
 Drossbach, 191.  
 Dubois, 21.  
 Endemann, 126.  
 Fizean, 92.  
 Foote, 226, 232.  
 Forbes, 65, 103.  
 Franz, 94, 108.  
 Frémy, 61.  
 Fresenius, 228.  
 Friedel, 135.  
 Glaser, 229.  
 Gmelin, 2.  
 Groshaus, 150.  
 Guyton, 5, 6.  
 Haber, 239.  
 Haensch, 177.  
 Hallopean, 220.  
 Hannay, 121.  
 Hare, 18.  
 Harris, 211.  
 Harrison, 97.  
 Hautefeuille, 113, 114, 118, 125, 159, 173, 184.  
 Henneberg, 52.  
 Henry, 60.  
 Hermann, 49, 83, 86, 88-90.  
 Hintz, 228, 240.  
 Hirschwald, 186.  
 Hjortdahl, 87.  
 Holmquist, 242.  
 Hornberger, 129.  
 Huggins, 107.  
 Iniray, 188.  
 Jannettaz, 124.  
 Keepport, 175.  
 Klaproth, 1, 3, 8, 9.  
 Knop, 112.  
 Kochs, 189.  
 Landolt, 217, 248.  
 Larsson, 214.  
 Lengfeld, 219.  
 Levy, 145.  
 Linnemann, 154, 155, 158.  
 Mallard, 120.  
 Mallet, 71, 134.  
 Margottet, 159.  
 Marignac, 76.

Matthews, 244–247.

Mayrhofer, 147.

Mazade, 57.

McKean, 201.

Melliss, 106.

Mendelejeff, 110.

Meyer, 162.

Mixter, 122.

Moissan, 203, 219, 225.

Morehead, 193.

Müller-Jacobs, 224.

Muspratt, 54.

Nilson, 127, 128, 139.

Nordenskjöld, 77, 119.

Nylander, 81.

Ostwald, 248.

Ouvrard, 161, 169, 171, 196, 197.

Payen, 98.

Paykull, 123, 136.

Pécharde, 206.

Perrey, 173, 184.

Pettersson, 139.

Pfaff, 19.

Philipp, 130, 133.

Phipson, 85, 218.

Piccini, 165, 216.

Pisani, 80.

Possetto, 238.

Potyka, 72.

Rammelsberg, 115–117, 164.

Rath, 111.

Read, 207.

Riordan, 178.

Rivot, 56.

Rose, 45.

Rose, G., 75.

Scheerer, 47, 48, 50.

Schmidt, 177.

Schrötter, 64.

Seubert, 248.

Silviera, 21.

Sjögren, 55, 58.

Smith, 211.

Sorby, 102, 104.

Soret, 138.

Sprengel, 32.

St. John, 222.

Stolba, 149, 180.

Streit, 94.

Strohmeyer, 22, 74.

Svanberg, 51.

Tessié du Motay, 95.

Thalén, 101.

Traube, 223.

Trommsdorff, 7, 38.

Troost, 68, 69, 73, 79, 82, 113, 114, 118,  
125, 161, 169, 171, 204, 205.

Truchot, 233.

Van der Plaats, 160.

Vanquelin, 4.

Venable, 190, 195, 202, 210, 212, 213,  
221, 230, 234–236.

Vincent, 132, 140.

Vogt, 99.

Walker, 176.

Walker, P. H., 243.

Waller, 198.

Warren, 67, 185.

Websky, 91.

Weibull, 168.

Weller, 143.

Wells, 226, 232.

Welsbach, 172, 179.

Wilkins, 162.

Willgerodt, 167.

Winkler, 187, 192.

Witt, 208.

Wunder, 109.

## MATTER INDEX.

*Figures refer to the numbers in the second column.*

- Affinity, 147.  
Alkaline-earth Zirconates, 197, 221.  
Alkaline tartrates, 129.  
Alkaline Zirconates, 196, 221.  
Aluminium, separation from, 181.  
Analysis, 8, 52, 55, 66, 193.  
Analysis, comparison of methods of, 200.  
Analysis, qualitative, 238.  
Arsenate, 123.  
Artificial preparation of Zircon, 63, 70, 79, 84, 112, 173, 199.  
Atomic weight, 30, 31, 37, 39, 43, 141, 148, 160, 183, 234, 248.
- Behavior towards chromates and some organic acids, 239.  
Behavior towards dimethylaniline, 140.  
Behavior towards sulphuric acid, 163.  
Behavior towards trimethylaniline, 132.  
Behavior with bromine, 42.  
Bromides, 33.  
Bromine, behavior with, 42.
- Carbide, 219, 225.  
Carbon tetrachloride, action of, on, 162, 166.  
Chloride, preparation of pure, 190.  
Chlorides, 69, 115, 123, 129, 202, 210, 213.  
Chloridizing agent, 167.  
Chromates, 239.  
Comparison with thorium, 11, 169.  
Compounds, 136.  
Constituents of Zircon, 2, 154.  
Crystalline form of oxide, 77.  
Cyanogen compounds, 129.  
Cylinders, 131.
- Decompose, attempt to, 10.  
Decomposition, electro-chemical, 35.  
Density, 150.  
Derivatives, 244, 245.  
Detection, 241.  
Determination, 80, 157, 200.  
Determination in monazite, 229, 237.  
Determination in thorium nitrate, 228.  
Dimethylaniline, behavior towards, 140.  
Dioxide, 240.  
Discovery, 1.
- Electric furnace, preparation of metal in, 204.  
Electric furnace, preparation of oxide in, 205.  
Electric furnace, volatilization in, 203.  
Electro-chemical decomposition, 35.  
Electrolytic separation, 114.  
Emissive power, 240.
- Ferrocyanide, 86.  
Fluoride, 76, 110.  
Fluorides, double, 226, 232.  
Formate, 239.  
Fusion, 18.
- Granite, source in Norwegian, 218.
- Halogen compounds, 210, 227, 236.  
Hydrate, action of heat on, 176.  
Hydride, 194.  
Hydrogen peroxide, action on, 143, 165.  
Hydrogen peroxide, action on fluoride, 216.
- Illuminating power of oxide, 222.  
Iodide, tetra, 227.  
Iron, separation from, 243, 247.  
Isomorphism with silica, 75.  
Isomorphism with titanous acid, 109.
- Jargonium, 102, 103.
- Light, 93, 95-100, 133, 158, 189, 198, 217.  
Light, color of emitted, 201.  
Light, emissive power, 177.
- Magnesium, precipitation by, 185.  
Metal, 71, 82, 85, 106, 108, 204.  
Metallurgy, application in gold, 175.  
Methods of analysis, comparison of, 200.  
Microchemical reactions, 145, 192.  
Molybdate, 206.  
Monazite, determination in, 229, 237.  
Mordant, uses as, 215.
- Niobate, 214, 242.  
Nitride, 71.  
Nitrides, preparation of, 246.  
Norium, 51, 59, 89.

- Occurrence, 3, 5, 22, 47, 50, 64, 65, 91, 111, 119, 134, 195, 233.  
 Occurrence in plants, 32.  
 Occurrence in spring water, 57, 60.  
 Opening up Zircon, 180.  
 Organic compounds, action of chloride on, 135.  
 Orthophosphate, 123.  
 Oxalates, 230.  
 Oxide, 120, 121.  
 Oxide, action of heat on amorphous, 116.  
 Oxide, action of hydrochloric acid on, 184.  
 Oxide, action of magnesium on, 194.  
 Oxide, action of phosphorus pentachloride on, 211.  
 Oxide, action of silicon chloride on, 118.  
 Oxide, behavior of, at high temperatures, 203, 207.  
 Oxide, crystalline form of, 77.  
 Oxide, diamagnetic, 187.  
 Oxide, illuminating power of, 222.  
 Oxide, preparation in electric furnace, 205.  
 Oxide, propagation of heat by, 124.  
 Oxide, properties of, 235.  
 Oxide, reduction by magnesium, 187.  
 Oxide, solubility in microcosmic salt bead, 186.  
 Oxychlorides, 188.  
 Oxyhalides, 236.  
 Pencils, Zirconia, 191.  
 Peroxide, 153, 183.  
 Peroxide, separation by hydrogen, 156.  
 Phosphate, 159.  
 Phosphate, double potassium, 161.  
 Phosphate, double sodium, 169.  
 Phosphorescence, 52.  
 Platinite, 128.  
 Precipitation, 45, 156.  
 Preparation, 21, 24, 36, 47-49, 72, 88, 108, 149, 178.  
 Preparation from ores, 189.  
 Preparation in electric furnace, 204.  
 Preparation of nitrate, 179.  
 Presence in plants, 32.  
 Production in United States, 182.  
 Pyroacetate, 44.  
 Qualitative analysis, 238.  
 Qualitative test, 62.  
 Reaction, microchemical, 145.  
 Reduction of dioxide, 7.  
 Salts, 49, 106.  
 Salts, double potassium, 20.  
 Salts, double sodium, 87.  
 Salts, properties of, 25, 53, 58.  
 Salts, soluble basic, 126.  
 Selenates, 163.  
 Selenites, 54, 127.  
 Separation by sulphur dioxide, 209.  
 Separation, electrolytic, 114.  
 Separation from earths, 90.  
 Separation from gallium, 146.  
 Separation from iron, 20, 21, 46, 56, 210, 243, 247.  
 Separation from niobic acid, 115.  
 Separation from silicon, 210.  
 Separation from thorium, copper, etc., 164, 231.  
 Separation from titanium, 26, 74, 80, 94, 152.  
 Separation from uranium, 243.  
 Silica, isomorphism with, 75.  
 Silicates, 174.  
 Silicofluoride, 23.  
 Silicon, comparison with, 120.  
 Similarity to titanium, 19, 20, 68, 109.  
 Source, 218.  
 Specific heat, 122, 139.  
 Spectroscopic detection, 241.  
 Spectrum, 101, 104, 105, 107, 114, 125, 138, 151.  
 Spectrum, phosphorescent, 142.  
 Sulpharsenate, 28.  
 Sulphate, 117, 123.  
 Sulphate, double potassium, 67.  
 Sulphide, 61.  
 Sulphites, 212.  
 Sulphonolybdate, 29.  
 Sulphotungstate, 27.  
 Sulphur dioxide, separation by, 209.  
 Sulphuric acid, behavior towards, 163.  
 Tannate, 224.  
 Tantalic acid, separation from, 115.  
 Technology, 130.  
 Tellurate, 40.  
 Tellurite, 41.  
 Tetrabromide, 245.  
 Tetrachloride, 244.  
 Tetraiodide, 227.  
 Thorium nitrate, determination in, 228.  
 Thorium silicate, not isomorphous, 171.  
 Titanic acid, isomorphism with, 109.  
 Trimethylamine, behavior towards, 132.  
 Tungstates, 220.  
 Uranium, separation from, 243.  
 Uses as mordant, 215.  
 Valerianate, 38.  
 Vanadinate, 34.  
 Vapor density, 69, 73.  
 Volatilization in electric furnace, 203.  
 Welsbach burners, 172, 208.  
 Zirconates, alkaline, 106, 221.  
 Zirconates, alkaline earth, 197, 221.  
 Zirconia, two earths in, 81.  
 Zirconium ethyl iodide, attempt to prepare, 170.  
 Zirconyl salts, 142.





SMITHSONIAN MISCELLANEOUS COLLECTIONS.

— 1258 —

ON THE  
CHEAPEST FORM OF LIGHT.

BY

S. P. LANGLEY

AND

F. W. VERY.



WASHINGTON CITY :  
PUBLISHED BY THE SMITHSONIAN INSTITUTION.

1901.

WASHINGTON, D. C.  
JUDD & DETWEILER, PRINTERS  
1901

## ON THE CHEAPEST FORM OF LIGHT.

FROM STUDIES AT THE ALLEGHENY OBSERVATORY.\*

BY

S. P. LANGLEY AND F. W. VERY.

The object of this memoir is to show by the study of the radiation of the fire-fly that it is possible to produce light without heat other than that in the light itself; that this is actually effected now by nature's processes, and that these are cheaper than our industrial ones in a degree hitherto unrealized. By "cheapest" is here meant the most economical in energy, which for our purpose is nearly synonymous with heat; but as a given amount of heat is producible by a known expenditure of fuel at a known cost, the word "cheapest" may also here be taken with little error in its ordinary economic application.

We recall that in all industrial methods of producing light there is involved an enormous waste, greatest in sources of low temperature, like the candle, lamp, or even gas illumination, where, as I have already shown, it ordinarily exceeds 99 parts in the 100; and least in sources of high temperature, like the incandescent light and electric arc, where yet it is still immense and amounts even under the most favorable conditions to very much the larger part.

It has elsewhere† been stated that for a given expense at least one hundred times the light should in theory be obtainable which we actually get by the present most widely used methods of illumination. This, it will be observed, is given as a minimum value, and it is the object of the present research to demonstrate that not only this possible increase, but one still greater, is actually obtained now in certain natural processes, which we know of nothing to prevent our successfully imitating.

It is now universally admitted that wherever there is light there has been expenditure of heat in the production of radiation existing in and as the luminosity itself, since both are but forms of the same energy; but this visible radiant heat which is inevitably necessary is not to be

\* Reprinted, with additional note, from the American Journal of Science, third series, vol. xl, No. 236, August, 1890.

† See results of an investigation by S. P. Langley, read before the National Academy in 1883, and given in "Science" for June 1, 1883, where it is shown that in the ordinary Argand burner gas flame indefinitely over 99 per cent of the radiant energy is (for illumination purposes) waste.

considered as waste. The waste comes from the present necessity of expending a great deal of heat in invisible forms before reaching even the slightest visible result, while each increase of the light represents not only the small amount of heat directly concerned in the making of the light itself, but a new indirect expenditure in the production of invisible calorific rays. Our eyes recognize heat mainly as it is conveyed in certain rapid ethereal vibrations associated with high temperatures, while we have no usual way of reaching these high temperatures without passing through the intermediate low ones, so that if the vocal production of a short atmospheric vibration were subject to analogous conditions, a high note could never be produced until we had passed through the whole gamut, from discontinuous sounds below the lowest bass up successively through every lower note of the scale till the desired alto was attained.

There are certain phenomena, long investigated, yet little understood, and grouped under the general name of "phosphorescent" which form an apparent exception to this rule, especially where nature employs them in the living organism, for it seems very difficult to believe that the light of a fire-fly, for instance, is accompanied by a temperature of  $2,000^{\circ}$ , or more, Fahr., which is what we should have to produce to gain it by our usual processes. That it is, however, not necessarily impossible, we may infer from the fact that we can by a known physical process produce a still more brilliant light without sensible heat, where we are yet sure that the temperature exceeds this. No sensible heat accompanies the fire-fly's light, any more than need accompany that of the Geissler tube, but this might be the case in either instance, even though heat were there, owing to its minute quantity, which seems to defy direct investigation. It is usually *assumed*, with apparent reason, that the insect's light is produced without the invisible heat that accompanies our ordinary processes, and this view is strengthened by study of the fire-fly's spectrum, which has been frequently observed to diminish more rapidly toward the red than that of ordinary flames.

Nevertheless, this, though a highly probable and reasonable assumption, remains assumption rather than proof, until we can measure with a sufficiently delicate apparatus the heat which accompanies the light and learn not only its quantity, but, what is more important, its quality. Apart from the scientific interest of such a demonstration is its economic value, which may be inferred from what has already been said. I have therefore thought it desirable to make the light of the fire-fly the subject of a new research, in which it is endeavored to make the bolometer supplement the very incomplete evidence obtainable from the visible spec-

may learn from elementary treatises, phenomena of phosphorescence are common to insects, fishes, mollusks, vegetables, and organic mineral matter. Among luminous insects the fire-fly of our fields

is a familiar example, though other of the species attain greater size, and perhaps greater intrinsic brilliancy, especially the *Pyrophorus noctilucus* Linn., found in Cuba and elsewhere. Its length is about 37<sup>mm</sup>, width 11<sup>mm</sup>, and it has, like *Pyrophori*, three light reservoirs—two in the thorax and one in the abdomen. To procure this Cuban fire-fly I invoked the aid of the Smithsonian Institution, and through the kindness of Professor Felipe Poey, of Havana, and Señor Albert Bonzon, of Santiago de Cuba in the Island of Cuba, living specimens of the *Pyrophorus noctilucus* were received here during the summer of 1889. I have also to acknowledge my obligations to Professor C. V. Riley and to Professor L. A. Howard, to whose knowledge and kind care I am doubly indebted.

After a preliminary spectral examination in Washington, I found it more convenient to continue the research at the Allegheny Observatory by means of the very special apparatus supplied by the liberality of the late William Thaw, of Pittsburgh, for researches in the lunar heat-spectrum.\* Photometric measurements throughout the spectrum of the insect's light were also made.

I have indicated the steps of the investigation, but the experiments have been so largely and so intelligently made by Mr. F. W. Very that it is just to consider him as an associate rather than an assistant in the researches. I shall accordingly in what follows not discriminate between what each has contributed.

#### HISTORICAL NOTES.

We make no attempt to give any bibliography of the subject, and these notes are confined to what seems important in the history of the physical side of it.

*Nathaniel Hulme*.†—Exper. 6. A dead shining glow-worm was put upon water, contained in a wide-mouthed phial, at the temperature of 58. The phial was then sunk in boiling hot water, and as the heat communicated itself to the contents of the phial, the light of the glow-worm became much more vivid.

Exper. 7. Another lucid dead glow-worm was put into warm water, at 114, to see if that degree of heat would extinguish the light, but, on the contrary, its glowing property was augmented. All the water was then poured off, yet the insect continued to shine for some length of time.

Exper. 8. Two living glow-worms were put into a one-ounce phial, with a glass stopple, and though they were perfectly dark at the time, yet if the phial was briskly rubbed with a silken or linen handkerchief till it became pretty warm, it seldom failed to make them display their

\* Described in the *Memoirs of the National Academy*, vol. iv, part ii, p. 112.

† *Philos. Trans. Roy. Soc., London*, vol. xc, pp. 180, 181, 1800.

light very finely. This experiment was very frequently repeated. It had the same illuminating effect upon the light of a dead glow-worm.

Exper. 9. The complete influence of 212 degrees of heat was now applied to the light of a glow-worm, by pouring upon one when dead, but in a luminous state, some boiling water. Its light was instantly extinguished thereby and did not revive. The experiment was repeated and with the same result.

*Macaire* \* (quoted by Becquerel) found that the luminous matter taken from the body of a glow-worm and heated, increased in brilliancy up to a temperature of about 41° C., after which the light diminished, became reddish, and ceased at 52° C. An electric current increased the luminosity in both the living insect and in the luminous part separated from the remainder of the body, but ceased to have any effect in a vacuum. Oxygen and carbon monoxide increased the light of the living insect and of the luminous matter taken from its body, but the light ceased in a vacuum, in hydrogen, in carbon dioxide, in sulphurous anhydride, and in sulphureted hydrogen.

*Carus* † observed that the luminous matter taken from the body of the glow-worm ceases to shine when dried, but glows again when moistened.

*Matteucci* ‡ found that the phosphorescent substance of the Italian glow-worm (*Lampyrus Italica*) soon ceased to glow in hydrogen or in carbon dioxide, but shone decidedly brighter in oxygen than in air, the oxygen being consumed and carbon dioxide appearing. He drew the conclusion that the production of light in this insect is entirely due to the combination of oxygen with carbon, which is one of the elements of the phosphorescent matter. The greatest brilliancy occurred at a temperature of 37° or 38° Cent., but all phosphorescence ceased above 50° or below - 6° Cent.

*Robert* § found that a glow-worm cut in halves continued to glow for half an hour, when the light ceased, but commenced again on the near approach of a candle, and continued as bright as ever for thirty-six hours, after which it was impossible to renew it.

*Pasteur* || has examined the spectra of our Pyrophorus without finding any appearance of bright or dark lines. He states that M. Gerné has made a similar observation on the spectrum of the glow-worm.

*Becquerel* ¶ gives a good summary of the results of previous observers. Since phosphorescent solids give banded spectra and thus differ from ignited solids and liquids which have continuous spectra, M. Becquerel

\* "Bibliothèque Univ. de Genève," 1821.

† "Analecten zur Natur- und Heilkunde," Leipzig, 1829; see also Comptes Rendus, lix, p. 407, 1864.

‡ "Ann. de chim. et de phys.," III, ix, p. 71, 1843; also in C. R., xvii, p. 309.

§ C. R., xvii, p. 627, 1843.

|| C. R., lix, p. 509, 1864.

¶ "La lumière," 1867.



concludes, from the apparent continuity of the spectrum of the light from phosphorescent animals, that their light approaches nearer to that of ordinary incandescence—a deduction which the following result renders unnecessary.

C. A. Young\* states that the "common" fire-fly gives a continuous spectrum, extending from a little above Fraunhofer's line C in the scarlet, to about F in the blue, gradually fading out at the extremities. He observes that it is noticeable that precisely this portion of the spectrum is composed of rays, which, while they more powerfully than any others affect the organs of vision, produce hardly any thermal or actinic effect. In other words, very little of the energy expended in the flash of the fire-fly is wasted.

(This is a most important and interesting inference, but it will be observed that this is necessarily rather assumed as highly probable than actually demonstrated, since the method did not permit the dealing with the invisible rays except by inference.)

It is quite different with our artificial methods of illumination. In the case of an ordinary gas light, experiments show that at most, one per cent of the radiant energy consists of *visible* rays, the rest being invisible heat; that is to say, over ninety-nine per cent of the gas is wasted in producing rays that do not help in making objects visible.†

Secchi‡ at first thought that the spectrum of the glow-worm was monochromatic, but with an improved spectroscope, recognized that other colors were present, though feebly, and decided that the spectrum was sensibly continuous.

Quatrefages,§ in connection with the paper of Secchi, remarks that the previous observations of Spallanzani and Macaire, repeated with much care by Matteucci and Becquerel, show beyond doubt that the light of glow-worms and elaters is due to slow combustion. Thus the light is extinguished in a vacuum, and in irrespirable gases, it reappears in contact with the air, it is perceptibly increased by the presence of pure oxygen, it persists after the death of the creature, and finally it is accompanied by the generation of carbon dioxide. Nevertheless, he points out that there is a distinct kind of phosphorescence in the marine *Noctilucide*, due to the contraction of muscular fiber, the shining tissue being seen through the translucent body wall. This species of phosphorescence is increased by irritants, but is independent of the presence of oxygen and is not extinguished or in any way modified by hydrogen or by carbon dioxide.

\* The American Naturalist, Salem, 1870, vol. iii, p. 615.

† S. P. Langley has shown that the waste is in fact even greater than this, see "Science," vol. i, No. 17, p. 482, 1883.

‡ C. R., lxxv, p. 321, 1872.

§ C. R., lxxv, p. 322, 1872.

*Robin* and *Laboulbene*\* find the luminous organs of *P. noctilucus* composed of irregularly polyhedral cells, 0.04<sup>mm</sup> to 0.06<sup>mm</sup> thick, between which pass very numerous fine tracheæ and nerves. The inner face of the organ is composed of adipose tissue, and the outer of a transparent modification of the ordinary chitinous covering of the insect. The authors conclude that the light is due to chemical decomposition of a nitrogenous body with formation of crystalline urates.

*Joussel de Bellesme*† finds that although the phosphorescent cells, when separated from the body of the insect, continue to glow for several hours, yet if crushed they instantly lose their illuminating power, which indicates that for the production of the light the living cells must retain their integrity, and that they are not mere reservoirs of a phosphorescent substance, but continuous generators of it. He surmises that the light-giving substance may be phosphureted hydrogen.

*Meldola*‡ is quoted by *Spiller*§ as having examined the glow-worm spectrum and determined its approximate limits.

*Conroy*|| finds the glow-worm's light green, and in a small direct vision spectroscope showing a continuous spectrum from C to b, appearing like a broad band of green light extending from 0.518 to 0.587 with a faint continuous spectrum into the red to 0.656.

*R. Du Bois*.¶—Perhaps the most important of previous memoirs on phosphorescent insects is by this writer. It contains an account of photometric measures in wave-length scale, and also of heat measures with the thermopile. The latter represent the only attempt even, in this direction, I know of, and seem to be judiciously made but to be insufficient (on account of the limitations of such apparatus) to establish the author's conclusion that the light is accompanied by no sensible heat. This conclusion, we repeat, though very probably correct, does not seem to rest on the evidence of an apparatus of at all the necessary sensitiveness. This memoir, however, appears to be in general an excellent one, and well worthy the student's attention.

From all these statements it is abundantly clear that not only physicists and chemists, but naturalists, have been led to conclude that this light is not associated indissolubly with any so-called vital principle or vital process, but it is a result of certain chemical combinations, and that nothing forbids us to suppose it may be one day produced by some process of the laboratory or manufactory. With this conclusion in mind, we now proceed to observations meant to demonstrate the fact that this

\* C. R., lxxvii, p. 511, 1873.

† C. R., xc, p. 318, 1880.

‡ "Proc. Entomological Soc.," p. iii, 1880.

§ "Nature," vol. xxvi, p. 343.

|| "Nature," vol. xxvi, p. 319, 1882.

¶ "Bulletin de la Société Zoologique de France," parts 1, 2, and 3, 1886.



process (presumably discoverable but still unknown) gives light without invisible heat.

These observations are: 1. Photometric. 2. Thermal.

#### PART 1.—PHOTOMETRIC OBSERVATIONS.

The first impression on viewing the light of the *Pyrophorus noctilucus* through a spectroscope is that it consists essentially of a broad band in the green and yellow, while with precaution we see this extending into and beyond the borders of the blue and orange, but not very greatly farther, and these have been taken by previous observers as its absolute limits. No one appears to have experimentally and distinctly answered the question, "Would the light not extend farther were it bright enough to be seen?" nor has it been proven as clearly as might be desired that the result depends on the quality rather than the quantity of the light, or given conclusive evidence, that if the light of the insect were as bright as that of the sun it would not extend equally far on either side of the spectrum.

It is impossible to increase the intrinsic brilliancy by any optical device, but if it be impossible to make the light of the insect as bright as that of the sun, it is on the other hand quite possible to make the light of the sun no brighter than that of the insect, and this would appear to be the first step in obtaining a definite proof that the apparently narrow limits of the insect's spectrum are due to the intrinsic quality of the light and not to its feeble intensity. The only conclusive method of determining this would appear to be to balance the light from the insect with that of a definite portion of sunlight by any ordinary photometric device; and having taken this sunlight as nearly equal as possible to that of the insect, though certainly not greater, to let this determined quantity fall on the slit of a spectroscope at the same time with the light from the insect, two spectra being formed one over the other in the same field and at the same time.

The actual doing this is not so easy as it might appear, owing to experimental difficulties connected with the insect, a part of which arises from the fact that its light is not only fitful but unequal, being of very varying intensities when not wholly intermittent.

The simplest way in which the experiment can be performed is perhaps the following:

The insect is placed immediately in front of the slit of a spectroscope, so that the light of its thoracic or abdominal portion falls upon the slit. This forms a narrow spectrum which should be brought into the lower or upper half of the field, the insect being attached to the spectroscopic apparatus in a position as nearly fixed as possible. The spectroscope is now placed with the axis of its collimator in the line of a ray of sunlight cast from a heliostat without. In the path of this ray is a screen

with a circular diaphragm covered with ground glass; a lens in front of the slit casts on one portion of it an image of the white circle formed by the ground glass, which image is the same size as the illuminating organ of the insect and forms a spectrum of the same height in the reserved portion of the field. A suitable disposition of lenses placed between the glass screen and the siderostat enables any degree of illumination to be given to the former, from full sunlight to nearly absolute darkness. If the normal spectrum be studied, a grating is selected of such open ruling that the entire visible spectrum of the first order can be seen in the field, but the grating is first so placed that what is seen is not the spectra but the reflected image of the slit, the grating thus acting (at first) the part of a mirror; so that the observer first sees the two circles of light of approximately equal size and brilliancy, one formed by the insect, the other by the sunlight, and the light of this latter, by the arrangement of lenses between the screen and the siderostat is then adjusted so that while remaining of the size of the insect, it is judged to have the same intrinsic brilliancy, or, at any rate, not a superior one.

The essential thing is that a photometric comparison shall be made of the two lights before the spectra are formed, and that under these conditions the sunlight is equal but not superior to that of the insect.

The necessary condition of equality of the two lights from which the spectra are to be formed, having thus been secured, the grating is moved until the two spectra are brought into the field. The result of this direct test is that the solar spectrum when intrinsically of the same brightness, or even when clearly of less brightness than that of the insect, extends somewhat further toward the red and distinctly further toward the violet, the insect light being more intense than that of the sun for equal lights in the green, but ending more abruptly on the violet side.

It may be added that when the insect's light grew brighter the increment appeared to be more in the blue end or as if the average wavelength diminished with the intensity, but there was not opportunity to put this beyond doubt.

Photometric observations in the prismatic spectrum were made previously to the adoption of the arrangement above detailed, the first being on July 1, 1889, using thoracic light. The insect was mounted on an adjustable stand, to which it was attached loosely, so as to give it such freedom of motion as is needed to insure its emitting the light. It was consequently necessary to readjust its position incessantly, and this necessity constitutes a very obvious difficulty. The thoracic light spots are two ovals, each about  $2^{\text{mm}}$  by  $1.5^{\text{mm}}$  (see plate I, Fig. 1). Their light is not so bright as the abdominal light, but much steadier, and like that, of a decidedly greenish hue. One of these oval spots was placed over the center of a slit, open just enough to receive the light, or about  $1.5^{\text{mm}}$ . This slit was in the focus of a glass lens of  $8^{\text{mm}}$  aperture

and 82<sup>cm</sup> focus, which acted as a collimator. The prism was a very large one of flint (faces 11.5<sup>cm</sup> high, 10.5<sup>cm</sup> wide), whose mounting included an automatic minimum deviation attachment. The observing lens was similar to the collimator, with a low-power eye-piece in whose field was a pair of heavy vertical parallel wires. The whole was mounted on the spectrometer, primarily designed for bolometric measures and fully described elsewhere.\* The insect turned so as to show the abdominal light is depicted in plate I, Fig. 2.

The observer waited for some time in a wholly darkened room, and to the eye thus rendered sensitive, the visible spectrum, before magnification, was about 2<sup>mm</sup> high and 20<sup>mm</sup> long, the parallel wires being distinctly visible in the indigo at a setting of 45° 25', corresponding to a wave-length of 0<sup>μ</sup> 468, and in the red at 43° 53', corresponding to 0<sup>μ</sup> 640. The spectrum then was visible from a little beyond F to near C, or through a range of 0<sup>μ</sup> 172. As might have been anticipated from the greenish color of the light, the maximum brilliancy was in the green near E, or near wave-length 0<sup>μ</sup> 53.† From this point the light fell away on both sides more rapidly than in the solar spectrum. (See plate II, A, B.)

July 2. A comparison of the spectra of the thoracic and of the abdominal light gave the latter upon the average about double the intrinsic brightness of the former. This was only a crude estimate, but more exact methods under the limited time for experiment would have been useless, owing to the very fluctuating character of the light. In continuation of the photometric measurements of the preceding day on the thoracic light, this was compared with that from the flame of an ordinary Bunsen burner at its greatest luminosity, whose area was limited by a diaphragm to that of the size of the thoracic light. The light from the base of this luminous flame (height of flame about 3.5<sup>cm</sup>, air shut off at base of burner) gave a continuous spectrum, which in these first comparisons was alternated with that of the insect. The spectra were judged to be equal in the blue and the red, but that of the insect was much brighter in the green. Again, a spectrum being formed from light taken midway between the base and point of the flame was found to be everywhere too bright, but especially so in the red.

July 3. Continuation of photometric measures, but with abdominal light. (The abdominal luminous organ is shown in plate I, Fig. 2.)

Wires seen in indigo	45° 29'	0 463	Abdominal light.
" " red	43 47	0 663	Range 0 <sup>μ</sup> 200.
" " indigo	46 56	0 390	Range 0 <sup>μ</sup> 282.
" " red	43 21	0 772	Bunsen burner

(Luminous flame 4<sup>cm</sup> high, at point one-third down from top, just within inner and slightly darker cone, seen through hole 2.5<sup>mm</sup> in diameter.)

\* American Journal of Science, March, 1883, p. 188.

† In the normal spectrum the maximum has a wave-length 0<sup>μ</sup> 57.



SMITHSONIAN MISCELLANEOUS COLLECTIONS.

———— 1258 ————

ON THE  
CHEAPEST FORM OF LIGHT.

BY  
S. P. LANGLEY  
AND  
F. W. VERY.



WASHINGTON CITY :  
PUBLISHED BY THE SMITHSONIAN INSTITUTION.  
1901.

Glass being interposed, the heat due to this flame radiation fell to 14.5 divisions, or about 8 per cent of the original radiation, showing that of the quality of Bunsen flame heat immediately in question (that above  $3^{\mu}$  transmissible by glass), there was still something like 60 times that of the combined body and luminous radiation of the insect in the far less luminous flame. Subsequently, by the use of a lens giving greater concentration, measurable indications of insect radiation above  $3^{\mu}$ , and therefore distinct from any possible body heat, were obtained through glass, showing the flame radiation of this quality from an equal area of the same intrinsic brilliancy—i. e., invisible heat and of long wave-length, but shorter than  $3^{\mu}$ —to be about 400 times that of the insect.

These experiments were repeated with different luminous flames and with different insects on succeeding days. In some of them especially luminous insect specimens were secured, which, with favorable conditions of the galvanometer, gave very measurable deflections on the latter. By a similar use of the glass to that described, it appeared that flames whose intrinsic brilliancy is nearly comparable to that of a point below the middle of the candle flame, and whose total brilliancy is as exactly as possible comparable to that of the insect, give several hundred times the heat of the latter, even if we consider only that quality of heat which is found above  $3^{\mu}$ , while if we compare the total radiations (i. e., those directly observed without the use of the glass) the contrast is still stronger.

It follows that the insect light is accompanied by approximately one-four-hundredth part of the heat which is ordinarily associated with the radiation of flames of the luminous quality of those which were the subject of experiment. This value is confirmed by other methods which we do not give here. It will conduce to a clearer comprehension of this if we exhibit in a series of curves derived from our observations the spectral distribution of one unit of energy in the gas-flame spectrum (plate III, Fig. 1); of the electric arc spectrum (plate III, Fig. 2); of the sun (plate V, Fig. 3), and of the insect (plate III, Fig. 4). In all these the abscissæ are the same, the portion between  $0^{\mu}4$  and  $0^{\mu}7$  (violet to red) showing the part of the energy utilized in light, while that from  $0^{\mu}7$  to  $3^{\mu}$  shows the part wasted as invisible heat. The energy in each case being the same, the areas are the same, except that owing to the relative importance of the light heat curve (Fig. 4) only about  $\frac{1}{100}$  of the latter can be shown in the limits of the plate.

The curves in plate II deal with luminous intensity only, and give no means of drawing those economic conclusions which appear to follow from our experiments and which the curves in plate III supply. These curves (plate III) all exhibit the spectrum on the normal scale, from that easily visible, lying between  $0^{\mu}4$  in the violet and  $0^{\mu}7$  in the red, then to  $3^{\mu}$  near the limit of the glass transmission. In the case of the first three, representing spectra of the gas flame, the electric arc, and the sun, nearly all the energy lies above  $3^{\mu}$ . In that of the gas flame a consider-



able portion lies below  $3^{\circ}$  (and still more in that of the candle flame, if that were shown where most of the energy would lie below  $3^{\circ}$  or outside the limits of the drawing). The curves, then, we repeat, represent equal amounts of energy (which without sensible error we may assume to be all exhibited as *heat*) and inclose equal areas.

The total area represents in each case the expenditure of a unit of cost in thermal energy, the area between  $0^{\circ}4$  and  $0^{\circ}7$  the proportion of this utilized as *light*, though, as we have just stated, in the case of Fig. 4, the representative of the fire-fly spectrum, only a fraction of this can be shown (owing to the limits of the drawing).

Resuming, then, what we have said, we repeat that nature produces this cheapest light at about one-four-hundredth part of the cost of the energy which is expended in the candle flame, and at but an insignificant fraction of the cost of the electric light or the most economic light which has yet been devised, and that, finally, there seems to be no reason why we are forbidden to hope that we may yet discover a method (since such a one certainly exists and is in use on the small scale) of obtaining an enormously greater result than we now do from our present ordinary means for producing light.

#### APPENDIX.

##### *Determination in Calories of the Heat in the Luminous (Abdominal) Radiation of Pyrophorus noctilucus.*

The determination is reached by two steps: (1) The calibration of the galvanometer, so as to give the value of its division in calories, and (2) the inference from the observed deflection in divisions of the total of calories radiated.

1. The bolometer, whose face occupied  $0.19$  sq. cm. ( $a$ ), gave a deflection of  $342$  divisions ( $b$ ) at a distance of  $25$  cm. ( $r$ ) from a  $5$  cm. circular aperture filled by a blackened Leslie cube. Seen from the center of this aperture, the bolometer occupied, then  $\frac{a}{2\pi r^2} = 0.0000484$  of the hemisphere, and would have received this fraction of the total radiation, except that being placed exactly opposite the radiating surface, more than the mean radiation fell on it in a proportion which calculation shows to be about  $\frac{1}{2}$ . The fraction of the total radiation which it actually received, then, was  $0.0000645$  ( $c$ ).

Accordingly the total radiation would have caused a deflection  $\frac{b}{c} = 5300000$  divisions.

The surface of the cube was at a temperature of  $99^{\circ}$  Cent., and was limited by the diaphragm to an area of  $19.6$  sq. cm. ( $d$ ). The total radiation from one centimeter, then, would have caused a deflection of

$\frac{b}{cd} = 270400$  div. The temperature of the bolometer, which was that of the apartment, was  $20^{\circ}$  C. According to Dulong and Petit's law, the radiation from such a surface at  $99^{\circ}$  C. to one at  $20^{\circ}$  C. would be 1.11 cal. per minute ( $e$ ), which does not greatly differ from our own independent determinations, and for  $10^{\text{sec.}} = 0.167$  ( $f$ ) (the time of the galvanometer swing) it equals  $0.185$  ( $ef$ ). Hence  $\frac{b}{cdef} = \frac{270400}{0.185} = 1462000$  div. is the potentiality of work in 1 calorie, to be expressed in the swing of the galvanometer needle, and  $1 \text{ div.} = 0.000000684$ .

2. The galvanometer received the fire-fly radiation through a lens which occupied 0.00655 of a hemisphere, and would have transmitted this fraction of the total heat, except for its position, which caused it to transmit  $\frac{1}{2}$  more than the average, which is 0.00873 ( $g$ ). The measured radiation from this fractional part gave  $0.84$  div. ( $h$ ) and  $\frac{h}{g} = 96.2$  div. is the deflection which would be given by the total abdominal emission, or

$$96.2 \times 0.000000684 = 0.0000658.$$

Since the luminous surface has an area of about  $\frac{1}{2}$  sq. cm., this corresponds to a radiation of  $0.00039$  per sq. cm. of radiating surface in the time of the galvanometer needle's swing, or to  $\frac{0.0004}{f} = 0.0024$  per sq. cm. per minute.

(Taking the water-equivalent of the bulb of an ordinary mercurial thermometer 1 cm. in diameter at  $0.25$  we find

$$\frac{0.84 \times 0.000000684}{0.25} = 0.0000023,$$

showing that if such a thermometer were placed in the position occupied by the bolometer its rise during the time of the latter's exposure to the radiation of the insect would be between two and three one-millionths of a centigrade degree.)

#### NOTE, 1901.

These notes, added to the preceding article with the assistance of Dr. H. C. Bolton, are simply intended to point out some of the principal additions to our knowledge of the subject which have appeared during the last ten years; and they make no pretension to be in any sense a bibliography.

About one year after publication of the preceding paper Dr. William H. Seaman, of Washington, wrote an article "On the Luminous Organs of



Insects" (Proc. Am. Soc. Micros., 14th meeting), in which he claims that the emission of light by these insects is connected with the process of oxidation. He says: "In several species of luminous insects the structure of the photogenic organs is specially adapted to secure the most copious supply of air throughout the substance of the gland," and he concludes that this peculiar structure is to enable the glands to produce light by the action of oxygen, the energetic principle of the air.

Lophin ( $C_{11}H_{16}N_2$ ) exhibits this phenomenon at the low temperature of  $10^\circ C.$ , in the presence of oxygen and alkalies.

The identity of the light from living beings and that from carbon compounds has been established by spectroscopic observation. The caustic alkali, which is incompatible with organic life, can be replaced by cholin, neurin, and other bodies that are known constituents of living beings.

The quantity of these materials required to produce light is very small; 1.82 grams of lophin dissolved in 25cc. strong alcoholic potash gave light for 20 days throughout its entire mass.

The Russian experimenter extracted with ether from the bodies of 180 *Pelagia noctiluca* a thick yellow liquid that shone beautifully on shaking with an alkali.

In 1893 Raphael Dubois,\* whose monograph, "Les Elaterides lumineux" (Bull. Soc. Zoolog., 1886) has been cited, published a paper recording his observations on a myriapod from Algeria, *Oryza barbarica* (C. R., cxvii, 184). He confirmed the statement of M. Gazagnaire, who had observed (in May, 1888) that the phosphorescent substance is secreted by these insects on the sternal and episternal plates as a yellowish viscid liquid. The excretion is distinctly acid, a fact that disproves, he says, the oxidation theory, and he gives to the substance the name "luciferine."

Peter Schmidt, of St. Petersburg, published a paper in Russian "On the luminosity of Midges," which was reproduced in 1895, in the Annals and Magazine of Natural History (series 6, vol. 25, p. 133). Schmidt divides luminous insects into two classes: A, those provided with special luminous organs, and, B, those having luminous micro-organisms living upon them. He places midges in the latter group.

In 1896 H. Muraoka examined lampyrid beetles collected in Kyoto, Japan, and found they emitted both actinic and Röntgen rays; he noted reflection of the rays, but was unable to determine refraction, interference, and polarization. Muraoka found the entire body actinically active, and to increase the light sprinkled the insects with water; he also observed that the dead beetles were luminous when kept moist and when rubbed. (Wied. Ann. Phys., vol. 59, p. 773.)

\* See also paper by Dubois on Physiological Light in Smithsonian Report for 1895.

No attempt is here made at a complete bibliography, but the following papers may be consulted by the reader :

C. Verhoeff ; Zur Biologie von *Phosphaenus hemipterus* und Verwandten. Verh. Ver. Rheinland, 1894, 208.

W. L. Distant ; (Luminosity of Fulgoridæ.) Trans. Entomol. Soc. London, 1895, 429.

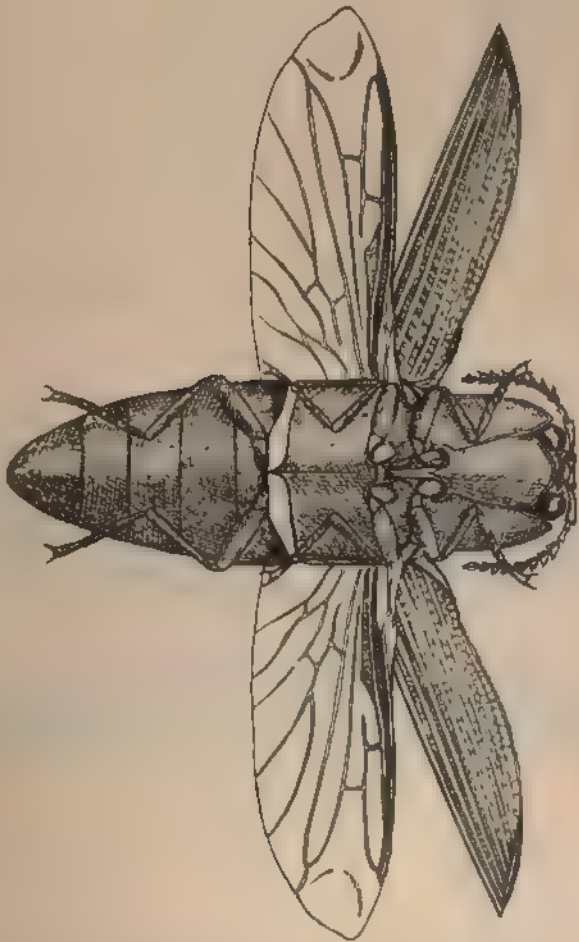
A. S. Packard ; Phosphorescence of Organs of Insects. J. N. Y. Entomol. Society, 1896, 61.

R. Dubois ; Les œufs lumineux et leurs larves. Leçons de physiologie générales et comp. xii, Paris, 1898, p. 361.

Besides these biologic sources of light, there have been discovered several kinds of mineral matter possessing the extraordinary power of emitting visible, actinic, and skiagraphic rays. Becquerel, in 1896, announced that all salts of uranium, whether fluorescent or not, yield invisible radiations capable of discharging electrified bodies and of producing skiagraphic images on photographic plates ; and this property persisted even after long confinement in a double leaden box.

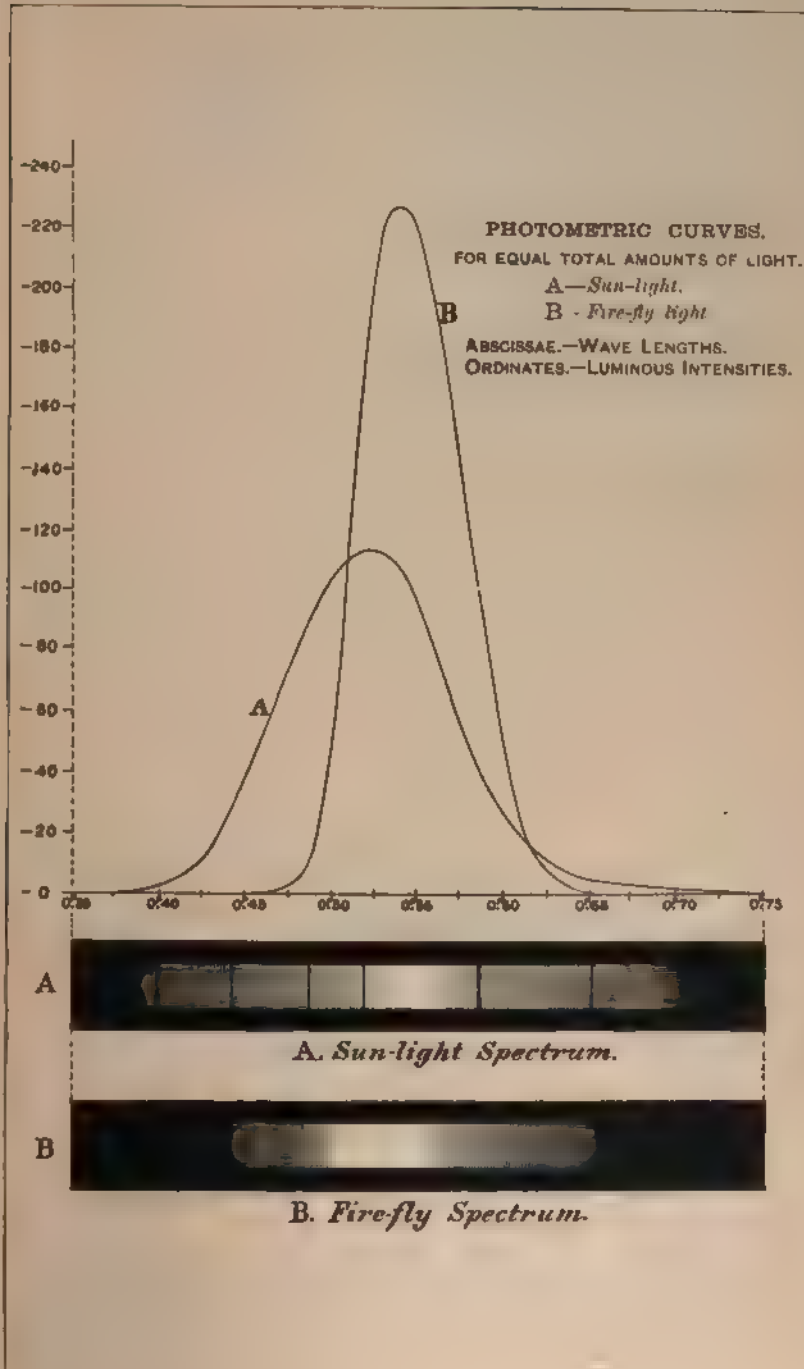
Two years later Mme. Sklodowska Curie, of Paris, having examined a series of uranium minerals, found in pitchblende a substance emitting Becquerel rays, so called, 4,000 times stronger than uranium compounds, and named the element believed to be contained therein "polonium." A few months later M. and Mme. Curie announced a second body having similar properties ; this they called "radium." Not long after, a third element, "actinium," was added to the list. Radium, which is the best known, is analogous to barium and accompanies it in chemical reactions so closely that the two have not been satisfactorily separated.

I have, with Dr. H. C. Bolton, verified the fact that the rays given out by small amounts of radium compounds not previously insulated yield, under favoring circumstances, photographic transparencies very clear in details ; they also exert chemical action, and they excite fluorescence in barium-platino-cyanide screens even through plates of vulcanite, aluminium, etc., like Röntgen rays. These radio-active bodies have been studied by physicists and chemists for several years, but without success, in isolating the elements or in demonstrating the true source of the energy manifested.



PYROPHORUS NOCTILUCUS  
TWICE NATURAL SIZE

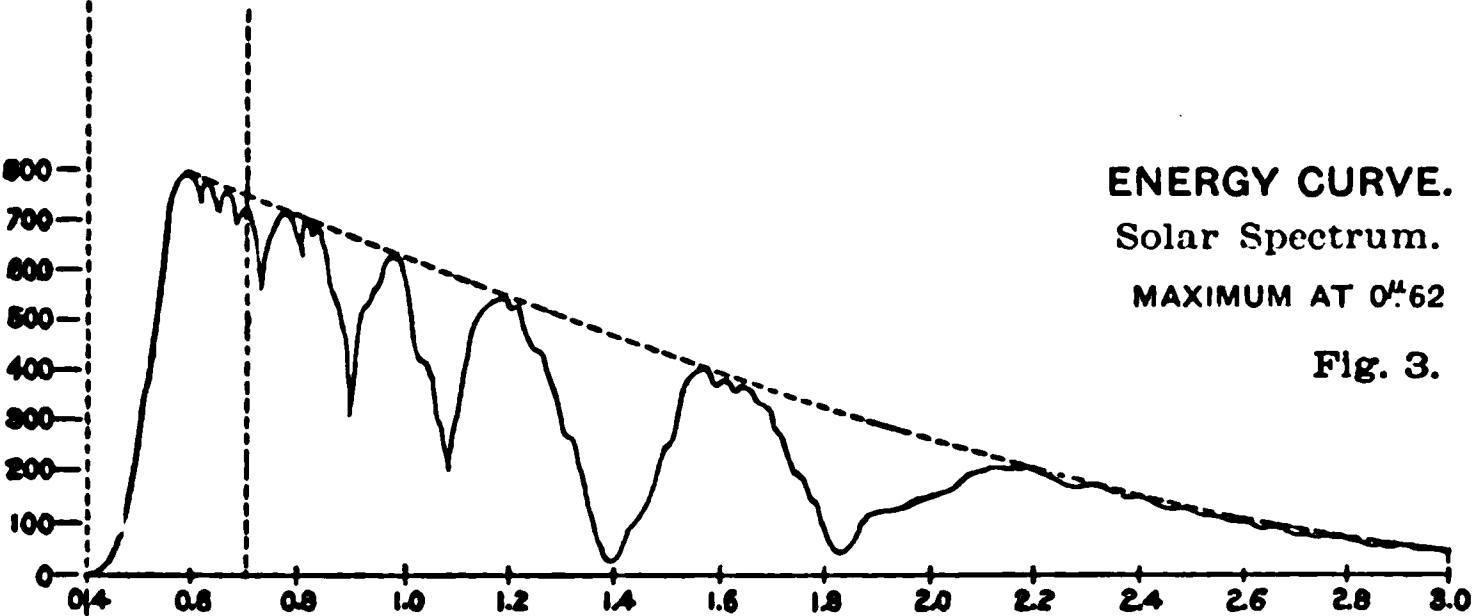
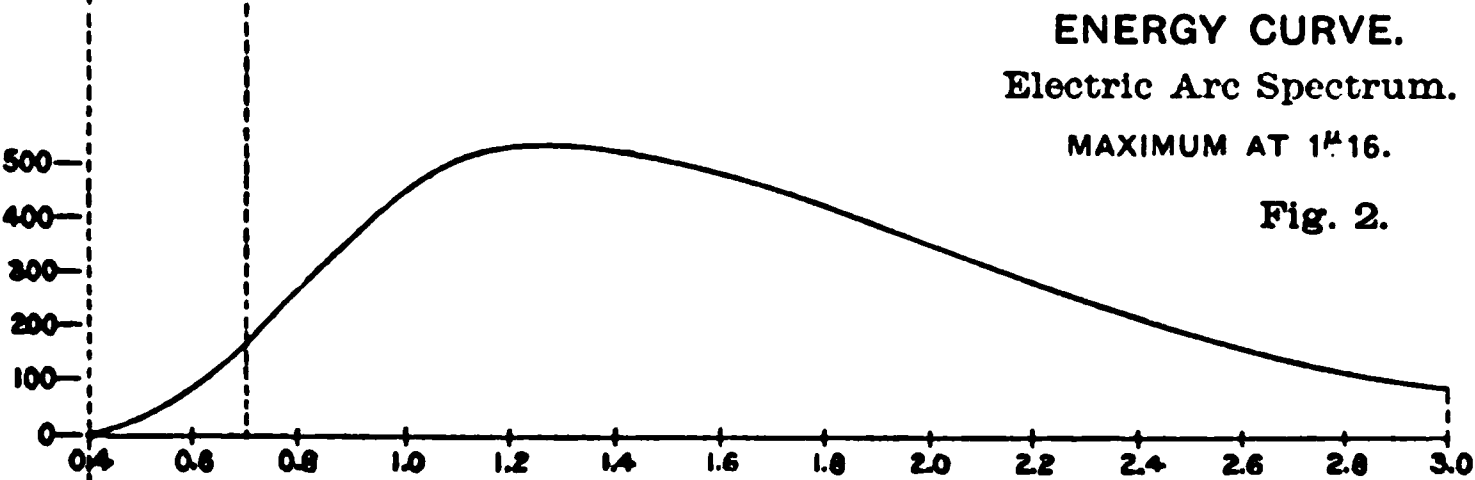






Four Curves of Equal Areas, showing one unit of heat displayed successively in heat spectrum of Gas, Electric Arc, Sun and Fire-Fly.

ABSCISSAE. — WAVE LENGTHS.  
ORDINATES. — ENERGY AS HEAT.







SMITHSONIAN MISCELLANEOUS COLLECTIONS

—1259—

LIST  
OF  
OBSERVATORIES



CITY OF WASHINGTON  
PUBLISHED BY THE SMITHSONIAN INSTITUTION  
1902



**The Lord Baltimore Press**  
THE FRISDENWALD COMPANY  
BALTIMORE, MD., U. S. A.

# LIST OF OBSERVATORIES.

---

## EXPLANATION OF SYMBOLS.

O—Chiefly engaged in astronomy of position.

AP—Chiefly engaged in astrophysical work.

Met—Conducts meteorological observations.

Mag—Conducts magnetic observations.

I—For purposes of instruction.

An asterisk prefixed signifies that the observatory is one whose position is given in the *American Ephemeris and Nautical Almanac for 1904*.

Meteorological stations are so numerous that it is not within the scope of this list to include them all, but only the more considerable. Observatories included for other reasons may occasionally receive the symbol Met where the meteorological observations alone would hardly justify an additional title.

Although many letters were sent to directors of observatories asking for information useful in the preparation of this list, and a very gratifying and painstaking response was made in most cases, it is realized that it is far from being complete and accurate, especially in the use of symbols. In the interest of greater usefulness it is requested that notices of errors and additions may be sent to the Smithsonian Institution by those who may have occasion to employ the list.



## UNITED STATES OBSERVATORIES.

---

### AKRON, Ohio.

Buchtel College Observatory .....I Met

### \*ALBANY, New York.

Dudley Observatory .....O

### ALBION, Michigan.

Albion College Observatory.

### \*ALFRED, New York.

Alfred University Observatory .....O

### \*ALLEGHENY, Pennsylvania.

Allegheny Observatory .....O AP

### ALLIANCE, Ohio.

Mount Union College, Morgan Observatory.

### AMHERST, Massachusetts.

Amherst College, Lawrence Observatory .....O

### \*ANN ARBOR, Michigan.

Detroit Observatory .....O

### \*ANNAPOLIS, Maryland.

United States Naval Academy Observatory.....I

### APPLETON, Wisconsin.

Lawrence University, Underwood Observatory .....O I

### ATCHISON, Kansas.

Midland College Observatory .....O I

### BALDWIN, Kansas.

U. S. Coast and Geodetic Survey Base Station.....Mag

### BALTIMORE, Maryland.

Johns Hopkins University Observatory .....I AP

Private Observatory of John R. Hooper.

Private Observatory of W. H. Numsen.

Private Observatory of Sullivan Pitts.

Private Observatory of Justice Stahn.

BARNESVILLE, Ohio.	
Olney Observatory.	
BATTLE CREEK, Michigan.	
High School Observatory.	
*BELOIT, Wisconsin.	
Beloit College, Smith Observatory .....	O
*BERKELEY, California.	
University of California, Students' Observatory .....	O I
BETHLEHEM, Pennsylvania. (See SOUTH BETHLEHEM.)	
BLOOMINGTON, Illinois.	
Illinois Wesleyan University Observatory .....	I
BLOOMINGTON, Indiana.	
Indiana University, Kirkwood Observatory .....	O
BLUE HILL, Massachusetts. (See HYDE PARK.)	
*BOSTON, Massachusetts.	
Boston University Observatory (12 Somerset Street).	
BOULDER, Colorado.	
University of Colorado Observatory .....	I
BROOKLAND, District of Columbia. (See WASHINGTON, D. C., Catholic University.)	
BROOKLYN, New York.	
Polytechnic Institute Observatory.	
Private Observatory of Mr. W. T. Gregg.	
Private Observatory of Mr. H. M. Parkhurst .....	AP
Private Observatory of Mr. James W. Ward.	
BRUNSWICK, Maine.	
Bowdoin College Observatory .....	I
BUFFALO, New York.	
Private Observatory of Mr. Henry Mills.	
*CAMBRIDGE, Massachusetts.	
Harvard College Observatory .....	AP O Met
CAMBRIDGEPORT, Massachusetts.	
Private Observatory of Mr. E. F. Sawyer.	
CARLINVILLE, Illinois.	
Blackburn University, Minton Observatory.	

**CARLISLE, Pennsylvania.**

Dickinson College Observatory.

**CHAMPAIGN, Illinois. (See URBANA.)****CHARLESTON, South Carolina.**

College of Charleston Observatory.

**CHARLOTTESVILLE, Virginia. (See UNIVERSITY OF VIRGINIA.)****CHELTENHAM, Maryland.**

United States Coast and Geodetic Survey, Principal Magnetic

Base Station .....Mag Met

**CHESTER, Pennsylvania.**Pennsylvania Military College, Theodore Hyatt Memorial  
Observatory.**CHICAGO, Illinois. (See also EVANSTON and WILLIAMS BAY.)**

University of Chicago, Students' Observatory .....O I

**\*CINCINNATI (Station O), Ohio.**

Cincinnati Observatory .....O

**CLAREMONT, California.**

Pomona College Observatory .....I Met

**CLEVELAND, Ohio.**

Case School of Applied Science, Case Observatory.....O

Ignatius College Observatory .....Met

Private Observatory of Dr. John N. Stockwell.

Private Observatory of Warner and Swasey.

Western Reserve University Observatory.

**\*CLINTON, New York.**

Hamilton College, Litchfield Observatory .....O

**COLLEGE PARK, California.**

University of the Pacific, Jacks-Goodall Observatory.....O

**COLORADO SPRINGS, Colorado.**

Colorado College Observatory .....I Met

**\*COLUMBIA, Missouri.**

University of the State of Missouri, Laws Observatory.....O

**COLUMBUS, Ohio.**

Ohio State University, Emerson McMillan Observatory.....AP

Private Observatory of R. W. McFarlane.

**CRETE, Nebraska.**

Doane College, Boswell Observatory.

**DELAWARE, Ohio.**

Ohio Wesleyan University, Perkins Observatory.

**DENVER, Colorado. (See UNIVERSITY PARK.)****DES MOINES, Iowa.**

Drake University Observatory.

**DUBUQUE, Iowa.**

Dubuque Observatory.

**DUE WEST, South Carolina.**

Erskine College Observatory.

**EASTON, Pennsylvania.**

Lafayette College Observatory .....O

**ECHO MOUNTAIN, California.**

Lowe Observatory .....O

**ELIZABETH, New Jersey.**

Observatory of Mr. Charles W. Plyer.

**ELMIRA, New York.**

Elmira College Observatory.

**EVANSTON, Illinois.**

Northwestern University, Dearborn Observatory .....O

Private Observatory of Dr. Marshall D. Ewell.

**FAYETTE, Iowa.**

Upper Iowa University Observatory.

**FLAGSTAFF, Arizona.**

Lowell Observatory .....O AP

**FORDHAM, New York. (See RIVERDALE.)****FORT DODGE, Iowa.**

Private Observatory of Mr. F. Hess.

**FORT WORTH, Texas.**

Fort Worth University Observatory.

**GAITHERSBURG, Maryland.**

International Latitude Observatory .....O



GALESBURG, Illinois.	
Knox College Observatory .....	0
GAMBIER, Ohio.	
Kenyon College Observatory .....	0
GENEVA, New York.	
Smith Observatory .....	AP
GEORGETOWN, District of Columbia. (See WASHINGTON, D. C.)	
GETTYSBURG, Pennsylvania.	
Pennsylvania College Observatory.	
*GLASGOW, Missouri.	
Morrison Observatory .....	0
GRAND RAPIDS, Michigan.	
West Michigan College Observatory .....	I
GREENCASTLE, Indiana.	
McKim Observatory .....	0
GRINNELL, Iowa.	
Iowa College Observatory.	
HANOVER, Indiana.	
Hanover College Observatory.	
*HANOVER, New Hampshire.	
Dartmouth College, Shattuck Observatory .....	0 AP
HARTFORD, Connecticut.	
Trinity College Observatory .....	0
*HAVERFORD, Pennsylvania.	
Haverford College Observatory .....	0
HOPKINTON, Iowa.	
Lenox College Observatory.	
HYDE PARK, Massachusetts.	
Blue Hill Meteorological Observatory (A. L. Rotch).....	Met
IOWA CITY, Iowa.	
State University of Iowa Observatory .....	0 I
IRVINGTON, Indiana.	
Butler College Observatory.	
ITHACA, New York.	
Cornell University Observatory .....	0 I Mag

LANCASTER, Pennsylvania.	
Franklin and Marshall College, Daniel Scholl Observatory.....	O I
LANSING, Michigan.	
State Agricultural College Observatory.	
LAWRENCE, Kansas.	
Kansas State University Observatory.	
LEBANON, Ohio.	
National Normal University, Clark Observatory.....	I
LEWISBURG, Pennsylvania.	
Bucknell University Observatory.	
LINCOLN, Nebraska.	
University of Nebraska Observatory .....	I
LINWOOD, Ohio.	
Private Observatory of R. H. McClure.	
LOS ANGELES, California.	
Private Observatory of B. R. Baumgardt.	
McMINNVILLE, Oregon.	
McMinnville College Observatory.	
*MADISON, Wisconsin.	
University of Wisconsin, Washburn Observatory.....	O AP
MARE ISLAND, California.	
Mare Island Observatory .....	O
MARIETTA, Ohio.	
Marietta College, Gurley Observatory .....	I
MEADVILLE, Pennsylvania.	
Allegheny College, Newton Observatory .....	I
*MIDDLETOWN, Connecticut.	
Wesleyan University Observatory .....	I
MINNEAPOLIS, Minnesota.	
University of Minnesota Observatory .....	O
MITCHELL, South Dakota.	
Dakota University Observatory.	
*MOUNT HAMILTON, California.	
University of California, Lick Observatory.....	O AP Met
MOUNT LOOKOUT, Ohio. (See CINCINNATI.)	

## \*NASHVILLE, Tennessee.

Vanderbilt University Observatory.

## NEW BRUNSWICK, New Jersey.

Rutgers College Observatory.

## \*NEW HAVEN, Connecticut.

Yale University, Winchester Observatory .....O AP

## NEW ORLEANS, Louisiana.

Tulane University Observatory .....I

## NEW YORK, New York.

\*Columbia University Observatory .....O

N. Y. Meteorological Observatory (Central Park).....Met

## NEWINGTON, Connecticut.

Private Observatory of Mr. D. W. Edgecomb.

## NORTHAMPTON, Massachusetts.

Smith College Observatory.

## \*NORTHFIELD, Minnesota.

Carleton College, Goodsell Observatory .....O AP

## NOTRE DAME, Indiana.

Notre Dame University Observatory.

## \*OAKLAND, California.

Chabot Observatory .....O

## OMAHA, Nebraska.

Creighton College Observatory .....O

## ORONO, Maine.

University of Maine Observatory .....O I

## OXFORD, Mississippi. (See UNIVERSITY, Mississippi.)

## PARKVILLE, Missouri.

Park College, Charles Smith Scott Observatory.....O I

## PELLA, Iowa.

Private Observatory of R. R. Beard.

## PHILADELPHIA, Pennsylvania.

Philadelphia Astronomical Observatory (formerly High

School Observatory) .....O AP

\*University of Pennsylvania, Flower Astronomical Observatory..O

<b>*POUGHKEEPSIE, New York.</b>	
Vassar College Observatory .....	0
<b>*PRINCETON, New Jersey.</b>	
Halsted Observatory .....	0 AP
John C. Green School of Science Observatory .....	0
<b>*PROVIDENCE, Rhode Island.</b>	
Brown University, Ladd Observatory .....	0 AP
Seagrave Observatory .....	0
<b>RALEIGH, North Carolina.</b>	
Private Observatory of Col. A. W. Shaffer.	
<b>READVILLE, Massachusetts. (See HYDE PARK.)</b>	
<b>RICHMOND, Indiana.</b>	
Earlham College Observatory.	
<b>RIVERDALE, New York.</b>	
Private Observatory of Mr. William Meikleham.	
<b>ROCHESTER, New York.</b>	
Warner Observatory. (Closed.)	
<b>*SAINT LOUIS, Missouri.</b>	
Washington University Observatory .....	0
<b>*SAN FRANCISCO, California.</b>	
Davidson Observatory .....	0
<b>SAN JOSÉ, California. (See MOUNT HAMILTON.)</b>	
<b>SANTA CLARA, California.</b>	
Santa Clara College Observatory .....	0
<b>SEATTLE, Washington.</b>	
University of Washington Observatory.	
<b>SITKA, Alaska.</b>	
United States Coast and Geodetic Survey Base Station.....	Mag
<b>*SOUTH BETHLEHEM, Pennsylvania.</b>	
Lehigh University, Sayre Observatory .....	0
<b>*SOUTH HADLEY, Massachusetts.</b>	
Mount Holyoke College Observatory .....	I
<b>SPICELAND, Indiana.</b>	
Private Observatory of Mr. William Dawson.	

SWARTHMORE, Pennsylvania.	
Swarthmore College Observatory .....	I
*SYRACUSE, New York.	
Syracuse University, Holden Observatory.	
TARRYTOWN, New York.	
Private Observatory of Mr. Charles H. Rockwell.....	O
*TROY, New York.	
Rensselaer Polytechnic Institute Observatory .....	O
*UNIVERSITY, Alabama.	
University of Alabama Observatory.	
*UNIVERSITY, Mississippi.	
University of Mississippi Observatory.	
*UNIVERSITY OF VIRGINIA, Virginia.	
University of Virginia, Leander McCormick Observatory.	O AP I
*UNIVERSITY PARK, Colorado.	
University of Denver, Chamberlin Observatory .....	O
UPLAND, Indiana.	
Taylor University Observatory .....	I
UPPER DARBY, Pennsylvania. (See PHILADELPHIA, Flower Ob-	
servatory.)	
URBANA, Illinois.	
University of Illinois Observatory .....	O
VEVAY, Indiana.	
Private Observatory of Mr. Charles G. Boerner.	
WAKE FOREST, North Carolina.	
Wake Forest College Observatory .....	I
WASHINGTON, District of Columbia.	
*Catholic University of America Observatory .....	O
*Georgetown University Observatory .....	O AP
*Smithsonian Institution Astrophysical Observatory .....	AP
United States Army Engineer School Observatory.	
*United States Naval Observatory .....	O Met
United States Weather Bureau.....	
Met	
WASHINGTON, Pennsylvania.	
Washington and Jefferson College Observatory.	

WATERVILLE, Maine.	
Colby College, Shannon Observatory.	
WELLESLEY, Massachusetts.	
Wellesley College, Whitin Observatory .....	0
WEST POINT, New York.	
United States Military Academy Observatory.....	I
WILLETS POINT, New York. (See WASHINGTON, D. C., Engineer School Observatory.)	
WILLIAMS BAY, Wisconsin.	
University of Chicago, Yerkes Observatory .....	0 AP
*WILLIAMSTOWN, Massachusetts.	
Williams College, Field Memorial Observatory .....	0
WILMINGTON, North Carolina.	
Private Observatory of Mr. Eugene Martin.	
WILMINGTON, Ohio.	
Wilmington College Observatory.	
WOOSTER, Ohio.	
University of Wooster Observatory .....	I
YANKTON, South Dakota.	
Yankton College, Clarke Observatory.	
YPSILANTI, Michigan.	
State Normal School Observatory.	

## FOREIGN OBSERVATORIES.

---

- AACHEN, Germany.**  
Meteorologisches Observatorium .....Met
- ABBADIA, France.** (See HENDAYE.)
- ABERDEEN, Scotland.** (See DUN ECHT.)
- \*ADELAIDE, South Australia.**  
Observatory .....O Met
- AGINCOURT, Canada.** (See TORONTO.)
- AIGOUAL, France.** (See MONTPELLIER.)
- \*ALGER, Algeria.**  
Observatoire à Bourzareah.....O AP Met  
Service Météorologique de l'Algérie.
- ALGIERS, Algeria.** (See ALGER.)
- ALLAHABAD, India.**  
Office Meteorological Reporter for Northwest Provinces and  
Oudh .....Met
- ALTENBURG, Germany.**  
Sternwarte.
- ALT KRASNE, Austria-Hungary.**  
Meteorolog. Observatorium des Neutrathaler Landwirth-  
schaftlichen Vereins .....Met
- ALTONA, Germany.** (See KIEL.)
- AMSTERDAM, Netherlands.**  
Filiale des Kgl. Niederländischen Meteorologischen Instituts.Met
- ANTANANARIVO, Madagascar.**  
Observatoire Royal .....Mag
- \*AREQUIPA, Peru.**  
Harvard College Observatory (Arequipa Station).....O AP
- \*ARMAGH, Ireland.**  
Observatory .....O
- \*ATHENS, Greece.**  
Observatoire National d'Athènes .....O Met

**AUCKLAND, New Zealand.**

Meteorological Observatory .....Met

**AVIGNON, France.**

Observatoire Météor. du Mont-Ventoux.....Met

**BAGNÈRES-DE-BIGORRE, France.**

Observatoire du Pic du Midi.....Met AP Mag

**\*BAMBERG, Germany.**

Remeis-Sternwarte .....O Met

**BANGALORE, India.**

Mysore State Observatory .....O Met

**BARNAUL, Russia.**

Meteorologicheskaja Observatoria .....Met

**BASEL, Switzerland.**

Astronomisch-Meteorologische Anstalt im Bernoullianum.O Met

**BATAVIA, Java.**

Koninklijk Magnetisch en Meteorologisch Observatorium .....Mag Met

**BAYONNE, France. (See HENDAYE.)****BEIRUT (Syria), Turkey.**

Observatory.

**BELFAST, Ireland.**

Queen's College Observatory.

**BELGRAD, Servia.**

Observatoire Astronomique et Météorologique .....O Met

**\*BERGEN, Norway.**

Bergens Observatorium .....O Met

**BERLIN, Germany. (See also TEGEL.)**

\*Königliche Universitäts-Sternwarte .....O

Meteorologisches Institut (Schinkelplatz 6) .....Met

\*Urania Sternwarte .....O

**BERNAL, Argentine Republic.**

Observatory .....Met

**BERNE, Switzerland.**

\*Sternwarte .....O

Tellurisches Observatorium .....Mag Met



**\*BESANÇON, France.**

Observatoire Astronomique, Météorologique et Chronométrique  
de Besançon .....O Mag Met

**BEUIL (Alpes-Maritimes), France.**

Annexe de l'Observatoire Bischoffsheim .....Mag

**BEUTHEN, Germany.**

Magnetic observations recorded photographically in connection  
with mining plants .....Mag

**BIDSTON, England. (See LIVERPOOL.)****\*BIRR, Ireland.**

Birr Castle Observatory .....O AP Met

**BOCHUM, Germany.**

Magnetic observations recorded photographically in connection  
with mining plants .....Mag

**BOGENHAUSEN, Germany.**

Königliche Sternwarte .....O Mag

**BOGOTÀ, Colombia.**

\*Observatorio Astronómico Nacional .....O  
Observatorio Flammarion.

**\*BOLOGNA, Italy.**

Osservatorio Astronomico e Meteorologico .....O Met

**\*BOMBAY, India.**

Government Observatory at Colaba .....Mag Met

**\*BONN, Germany.**

Universitäts-Sternwarte .....O AP

**\*BORDEAUX, France.**

Observatoire Astronomique et Météorologique.....O AP Met

**\*BOTHKAMP (near Kiel), Germany.**

Sternwarte des Herrn Kammerherrn von Bülow.....O AP

**BREMEN, Germany.**

Meteorologisches Observatorium .....Met  
Observatorium der Navigations-Schule.

**\*BRESLAU, Germany.**

Universitäts-Sternwarte .....O Met

**BREST, France.**

Observatoire de la Marine .....Met

**BRIGHTON, England.**

Private Observatory of Mr. A. Stanley Williams.....AP

**\*BRISBANE, Queensland.**

Weather Bureau .....Met

**BRUSSELS, Belgium. (See BRUXELLES.)****\*BRUXELLES, Belgium.**

Observatoire Royal de Belgique à Uccle.....O Mag Met

**BUCURESCI, Roumania.**

Institutul Meteorologic .....Mag Met

**BUDAPEST, Austria-Hungary.**

\*Geodätisches Observatorium des K. Ung. Josephs-Polytechnikums.

K. Ung. Reichsanstalt für Meteorologie und Erdmagnetismus .....Mag Met

**BUENOS AIRES, Argentine Republic.**

Observatorio Meteorológico del Colegio Pio IX de Artes y Oficios—Almagro .....Met

**BUSHEY HEATH, England.**

Private Observatory of Mr. J. K. Tarrant, Craven College.

**CADIZ, Spain. (See SAN FERNANDO.)****\*CAIRO, Egypt.**

Observatoire Khédivial. (The Director General, Survey Department, Public Works Department, Cairo, Egypt.).....O

**CALCUTTA, India.**

Meteorological Office .....Met

Observatory of St. Xavier's College (10 Park Street).....O

**CAMBRIDGE, England.**

\*Cambridge Observatory .....O AP

Observatory of Mr. H. F. Newall .....AP

**CAMEN DE PATAGONES, Argentine Republic.**

Observatory .....Met

**\*CAPE TOWN, Cape Colony.**

Royal Observatory .....O AP Met

**CARACAS, Venezuela.**

Observatorio Astronómico .....O Met

**CARLSBURG, Austria-Hungary.**

Sternwarte.

**CASAMICCIOLA, Italy. (See ISCHIA.)****CATANIA, Italy.**

\*Osservatorio Bellini sull' Etna .....AP Met

R. Osservatorio .....O AP Met

**CHANG-HAI, China. (See SHANGHAI.)****CHAPULTEPEC, Mexico. (See TACUBAYA.)****\*CHARKOW, Russia.**

University Observatory .....O

**CHEMNITZ, Germany.**

Königlich Sächsisches Meteorologisches Institut .....Met

**CHERBOURG, France.**

Observatoire de la Marine .....O

**CHRISTIANIA, Norway.**

Meteorologisk Institut .....Mag Met

\*Universitets Observatorium .....O Mag

**CHUBUT, Argentine Republic.**

Observatory .....Met

**CLAUSTHAL, Germany.**Magnetic observations recorded photographically in connection  
with mining plants .....Mag**CLERMONT-FERRAND, France.**

Observatoire Météorologique du Puy-de-Dôme.....Met

Station Météorologique de Clermont-Ferrand.....Met

**COIMBRA, Portugal.**

\*Observatorio Astronomico da Universidade .....O

Observatorio Meteorologico da Universidade de Coimbra.Mag Met

**COLABA, India. (See BOMBAY.)****COLLOONEY, Ireland. (See MARKREE.)****COLLURANIA, Italy. (See TERAMO.)****COLOMBO, Ceylon.**

Surveyor General's Office .....Met

**CONSTANTINOPLE, Turkey.**

Observatoire Impérial Météorologique .....Met

COPENHAGEN, Denmark. (See KJÖBENHAVN.)

CORDOBA, Argentine Republic.

\*Observatorio Nacional Argentino .....O  
Oficina Meteorológica Argentina .....Met

CORK, Ireland.

Observatory of Queen's College.

COURGNÉ (Torino), Italy.

Osservatorio del Collegio Salesiano .....Met

CRACOW, Austria-Hungary. (See KRAKOW.)

CRONSTADT, Russia. (See KRONSTADT.)

\*CROWBOROUGH, Sussex, England.

Starfield Observatory, Dr. Isaac Roberts .....AP

CURITYBA (Paraná), Brazil.

Meteorological Observatory of the Telegraph Department....Met

CUYABÁ (Matto Grosso), Brazil.

Observatorio Meteorologico do Collegio Salesiano.....Met

CZERNOWITZ, Austria-Hungary.

Landwirthschaftliche Landes-Mittelschule .....Met

\*DANZIG, Germany.

Observatorium der Naturforschenden Gesellschaft.....O

DARAMONA, Streete, Co. Westmeath, Ireland.

Private Observatory of Mr. W. E. Wilson.....AP

DAR-ES-SALAM, East Coast Africa.

Magnetic Survey of German Colonies, Base Station.....Mag

DE BILT, Netherlands. (See UTRECHT.)

DEHRA DÛN, India.

Magnetic, Trigonometrical and Photoheliographic Survey of  
India, Base Station .....AP Mag Met

DERPT, Russia.

\*Imperatorskaia Astronomicheskaja Observatoria .....O  
Meteorologisches Observatorium .....Met  
Physikalisches Observatorium der Universität .....AP

DORPAT, Russia. (See DERPT.)

\*DRESDEN, Germany.

Königlicher Mathematisch-Physikalischer Salon.

## \*DUBLIN, Ireland.

Trinity College, Dunsink Observatory.....0

## \*DUN ECHT, Scotland.

Dun Echt Observatory (Removed to Royal Observatory,  
Edinburgh).

DUNSINK (County Dublin), Ireland. (See DUBLIN.)

## \*DURBAN, Natal.

Government Observatory .....0 Met

## \*DURHAM, England.

University Observatory .....0 Met

## \*DÜSSELDORF, Germany.

Sternwarte (Martinstrasse 101) .....0

## EALING (London W.), England.

Observatory of Dr. A. A. Common (63 Eaton Rise).....0

## EDINBURGH, Scotland.

\*City Observatory, Calton Hill.

\*Royal Observatory, Blackford Hill.....0 AP

Scottish Meteorological Society (122 George Street).....Met

## EKATERINBURG, Russia. (See KATHARINENBURG.)

## ELSFLETH, Germany.

Observatorium der Navigations-Schule.

## ETNA, Italy. (See ETNEO.)

## ETNEO, Sicily, Italy. (See CATANIA.)

## FALMOUTH, England.

Observatory .....Mag Met

## FIRENZE, Italy.

Osservatorio Ximeniano .....0 Met

\*Reale Osservatorio Astronomico di Firenze ad Arcetri .....0

\*R. Osservatorio Meteorologico del Museo.....Met

## FLORENCE, Italy. (See FIRENZE.)

## FOGLIZZO (Torino), Italy.

Osservatorio Meteorologico del Collegio Salesiano.....Met

## FORT WILLIAM, Scotland.

Ben Nevis Observatory .....Met

## FRANKFURT AM MAIN, Germany.

Meteor. Observatorium des Physikalischen Vereins.....Met

## FUNCHAL, Madeira.

Observatoire Météorologique .....Met

## GALATZ, Roumania.

Privat-Sternwarte.

## GEISENHEIM, Germany.

Monrepos Observatorium.

## GENEVA, Switzerland. (See GENÈVE.)

## \*GENÈVE, Switzerland.

Observatoire de Genève .....O

## GENOA, Italy. (See GENOVA.)

## \*GENOVA, Italy.

Osservatorio Meteorologico della Reale Università .....Met

Osservatorio del R. Istituto Idrografico.....O

## GEORGETOWN, British Guiana.

Botanic Gardens .....Met

## \*GLASGOW, Scotland.

Glasgow University Observatory.....O AP Met

## \*GOHLIS, Germany.

Sternwarte.

## \*GOTHA, Germany.

Herzogliche Sternwarte .....O

## GÖTTINGEN, Germany.

\*Königliche Sternwarte .....O AP

Physikalisches Institut, Abteilung für Geophysik .....Mag Met

## GRAZ, Austria-Hungary.

Physikalisches Institut der k. k. Carl-Franzens-Universität.

Sternwarte des Herrn Guenat.

\*Universitäts-Sternwarte .....O

## \*GREENWICH (London), England.

Royal Observatory .....O AP Mag Met

## \*GRIGNON (Côte-d'Or), France.

Observatoire du Prieuré de St. Jean .....AP Met

## GRONINGEN, Netherlands.

Astronomical Laboratory of the University .....O

## GUATEMALA, Guatemala.

Laboratorio Quimico Central Casa de Moneda .....Met

## GUAYAQUIL, Ecuador.

Observatorio Meteorológico del Colegio Nacional, San Vincent .....Met

## HABANA, Cuba.

Observatorio del Colegio de Belen .....O Mag Met

United States Weather Bureau .....Met

## HAIPHONG, Indo-China.

Observatoire Central de Phu lien.....O Met Mag

## HALIFAX, England.

Bermerside Observatory of Mr. Edward Crossley .....O Met

## HALLE AN DER SAALE, Germany.

Universitäts-Sternwarte .....O

## HAMBURG, Germany.

Deutsche Seewarte .....Met

\*Sternwarte .....O

## HAVANA, Cuba. (See HABANA.)

## \*HEIDELBERG, Germany.

Grossherzogliche Sternwarte .....O AP

## HELSINGFORS, Finland, Russia.

\*Astronomiska Observatoriet .....O

Meteorologiska Central-Anstalt .....Mag Met

## HENDAYE, France.

Observatoire Antoine d'Abbadie .....O Met

## \*HERÈNY (near Steinamanger), Austria-Hungary.

Astrophysikalisches Observatorium .....AP

## HERMSDORF (near Waldenburg), Germany.

Magnetic observations recorded photographically in connection with mining plants .....Mag

## HIEN-HIEN, China.

Observatoire de Tchang-kai-tchonang .....Met

## HOBART, Tasmania.

Timeball and Meteorological Observatory .....Met

**\*HONGKONG, China.**

Hongkong Observatory .....O Mag Met

**HONOLULU, Hawaiian Islands.**

Hawaiian Meteorological Office .....Met

U. S. Coast and Geodetic Survey Station .....Mag

**ILE TERCEIRA, Azores.**

Observatoire Météorologique.

**INNSBRUCK, Austria-Hungary.**

Physikalisches Institut der k. k. Leopold-Franzens-Universität.O

**IRKUTSK (Siberia), Russia.**

Magnetisch-Meteorologisches Observatorium .....Mag Met

**ISCHIA, Italy.**

R. Osservatorio Geodinamico di Casamicciola.

**JAIPUR, India.**

Maharajah of Jaipur Observatory .....O Met

**JALAPA, Mexico.**

Observatorio Meteorológico Central del Estado de Vera Cruz.Met

**\*JENA, Germany.**

Sternwarte und Meteorologisches Institut .....O Met

**JUIZ DE FORA, Brazil.**

Meteorological Observatory of the Hygiene Municipal Office..Met

**JUVISY, France.**

Observatoire de Camille Flammarion .....O Met

**\*KALOCSA, Austria-Hungary.**

Haynald-Observatorium .....O AP

**KARLSRUHE, Germany.**

Central-Bureau für Meteorologie und Hydrographie.....Met

\*Grossherzogliche Sternwarte (moved to Heidelberg in 1896).

**KATHARINENBURG (Siberia), Russia.**

Observatoire Magnétique et Météorologique .....Mag Met

**KAZAN, Russia.**

\*Astronomischeskaia Observatoria Imperatorskago Kazanskago

Universiteta .....O Mag Met

Observatoire-Engelhardt .....O Mag Met

**\*KEW, England. (See also RICHMOND.)**

Magnetic and Meteorological Observatory .....Mag Met



**KHARKOFF, Russia.**

Astronomisches Observatorium .....O  
 Meteorologisches Observatorium .....Met

**KIEF, Russia.**

Astronomisches Observatorium .....O  
 Meteorologisches Observatorium .....Met

**\*KIEL, Germany.**

Königliche Sternwarte .....O

**KIMBERLEY, Cape Colony.**

Meteorological Observatory .....Met

**KINGSTON, Canada.**

Observatory of Queen's University .....I

**\*KINGSTON, Jamaica.**

United States Weather Bureau Station.....Met

**KJÖBENHAVN, Denmark.**

Danske Meteorologiske Institut .....Mag Met

\*Universitets Astronomiske Observatorium .....O

**\*KODAIKANAL, India.**

Solar Physics Observatory .....O Mag AP Met

**\*KÖNIGSBERG, Germany.**

Universitäts-Sternwarte .....O

**KORNTHAL (near Stuttgart), Germany.**

Magnetic Survey of Württemberg, Base Station.... Mag

**\*KRAKOW, Austria-Hungary.**

K. k. Universitäts-Sternwarte .....O

**\*KREMSMÜNSTER, Austria-Hungary.**

Sternwarte des Benediktiner-Stiftes .....O AP Mag Met

**KRONSTADT, Russia.**

Morskaia Astronomicheskaja Observatoria .....O

**KUMAMOTO, Japan.**

Observatory 5th High School, under auspices of Seismological  
 Society .....Mag

**LANCASTER, England.**

Observatory .....I

**\*LA PLATA, Argentine Republic.**

Observatorio Astronómico de la Plata .....O Mag Met

**\*LEIDEN, Netherlands.**

Rijks Observatorium .....0

**\*LEIPZIG, Germany.**

Universitäts-Sternwarte .....0

**LEMBERG, Austria-Hungary. (See LWÓWIE.)****LEON, Mexico.**

Observatorio Meteorológico de Leon .....Met

**LEYDEN, Netherlands. (See LEIDEN.)****\*LIÈGE, Belgium.**

Observatoire Astronomique de l'Université de Liège.....0

**LISBOA, Portugal.**

Observatorio Astronomico na Escola Polytechnica .....0

Observatorio Meteorologico e Magnetico " Infante Dom Luiz "  
na Escola Polytechnica .....Mag Met**\*Observatorio Naval** .....0 Mag**\*Real Observatorio Astronomico de Lisboa (Tapada)** .....0**LISBON, Portugal. (See LISBOA.)****\*LIVERPOOL, England.**

Liverpool Observatory, Bidston, Birkenhead.....0 Met

**LOANDA, Angola, Portuguese West Africa.**

Observatorio Meteorologico .....Met

**LONDON, England. (See also EALING, GREENWICH, SOUTH  
KENSINGTON and TULSE HILL.)**

Meteorological Office (63 Victoria St., S. W.).....Met

Royal Meteorological Society (Princes Mansions, 70 Victoria  
St., Westminster, S. W.) .....Met**LORIENT, France.**

Observatoire de la Marine .....0

**LOUVAIN, Belgium.**

Observatoire du Collège de la Compagnie de Jésus.....0

Observatoire de M. le Docteur François Terby.

**LOVEDALE, Cape Colony.**

Private Observatory of Dr. A. W. Roberts.....0

**\*LÜBECK, Germany.**

Sternwarte der Navigations-Schule .....0 Met

**\*LUND, Sweden.**

Astronomiska Observatoriet .....0

**\*LUSSINPICCOLO, Austria-Hungary.**

Manora Sternwarte .....0

**LWÓWIE (Galicia), Austria-Hungary.**

Obserwatorium C. K. Szkoły politechnicznej.....0 Met

**\*LYME REGIS, England.**

Rousdon Observatory (of the late Sir Cuthbert Peek).....0 Met

**\*LYON, France.**

Observatoire Astronomique et Météorologique.....0 Mag Met

**MACHRIHANISH, Campbeltown, Scotland.**

Private Observatory of Mr. Franklin Adams.....0

**MADRAS, India. (See KODAIKANAL.)****MADRID, Spain.**

Instituto Central Meteorológico .....Met

**\*Observatorio Astronómico** .....0 Mag Met**MAGDEBURG, Germany.**

Wetterwarte der Magdeburger Zeitung .....Met

**\*MANILA, Philippine Islands.**

Observatorio Meteorológico .....0 AP Mag Met

**MANNHEIM, Germany. (See HEIDELBERG.)****\*MARBURG, Germany.**

Sternwarte .....Mag Met

**\*MARKREE, Ireland.**

Markree Observatory (of Col. Cooper).....0 Mag Met

**\*MARSEILLE, France.**

Observatoire .....0 Mag Met

**MAURITIUS, ISLAND OF. (See PORT LOUIS.)****\*MELBOURNE, Victoria.**

Government Observatory .....0 Mag Met

**MEUDON, France. (See PARIS.)****\*MEXICO, Mexico.**

Observatorio Meteorológico-Magnetico Central (Palacio Nacional) .....Mag Met

MILAN, Italy. (See MILANO.)

\*MILANO, Italy.

R. Osservatorio Astronomico di Brera .....O AP

\*MODENA, Italy.

Osservatorio Geofisico della R. Università .....O Mag Met

\*MONCALIERI, Italy.

Osservatorio del R. Collegio Carlo Alberto .....Met

MONT BLANC, France.

Observatoire Janssen au Sommet .....AP Met

Observatoire Vallot .....Met

MONTEVIDEO, Uruguay.

Observatorio Meteorológico del Colegio Pio de Villa Colón.O Met

MONT MOURNIER (Alpes-Maritimes), France.

Annexe de l'Observatoire Bischoffsheim.....O Met

MONTPELLIER, France.

Station Météorologique du Mont-Aigoual .....Met

\*MONTREAL, Canada.

McGill University Observatory .....O Met

MONTSOURIS, France. (See PARIS.)

MOSCOW, Russia. (See MOSKVA.)

MOSKVA, Russia.

\*Astronomicheskaja Observatoria .....O

Meteorologisches Observatorium des Landwirthschaftlichen

Instituts .....Met

Meteorologisches Observatorium der Universität.....Mag Met

MÜNCHEN, Germany. (See also BOGENHAUSEN and ZUGSPITZE.)

Königlich Bayerische Meteorologische Central-Station.....Met

\*Königliche Sternwarte .....O Mag

MUNICH, Germany. (See MÜNCHEN.)

NAGOYA, Japan.

Meteorological Station (auspices of Seismological Society)...Mag

NANTES, France.

Observatoire du Petit Port .....Mag

NAPLES, Italy. (See NAPOLI.)

## NAPOLI, Italy.

- \*R. Osservatorio Astronomico di Capo di Monte .....O  
 R. Osservatorio Vesuviano .....Mag Met

## NATAL, South Africa. (See DURBAN.)

## NEMURO, Japan.

- Meteorological Station (auspices of Seismological Society)...Mag

## \*NEUCHÂTEL, Switzerland.

- Observatoire Cantonal .....O

## \*NICE, France. (See also BEUIL and MONT MOURNIER.)

- Observatoire Bischoffsheim .....O AP Mag Met

## NICOLAS DE LOS ARROJO, Argentine Republic.

- Observatory .....Met

## \*NIKOLAIEFF, Russia.

- Morskaia Astronomicheskaja Observatoria .....O

## NORWICH, England.

- Private Observatory of Mr. Newbegin .....O

## NÜRNBERG, Germany.

- Wetterwarte .....Met

## OAXACA, Mexico.

- Observatorio Meteorológico del Estado de Oaxaca.....Met

## OBIR, Karinthia, Austria-Hungary.

- Meteorological Observatory .....Met

## ODESSA, Russia.

- Meteorologisches Observatorium .....Mag Met

- \*Sternwarte .....O

## Ó-GYALLA, Austria-Hungary.

- \*Astrophysikalisches Observatorium .....AP

Königlich Ungarisches Meteorologisches und Erdmagnetisches

- Central-Observatorium .....Mag Met

## OPORTO, Portugal. (See PORTO.)

## ORTHEZ, France. •

- Observatoire Carlier .....Met

## OTTAKRING, Austria-Hungary. (See WIEN, die von Kuffner'sche Sternwarte.)

## OUTWOOD, Surrey, England.

- Private Observatory of Mr. W. H. Maw .....O

**\*OXFORD, England.**

Radcliffe Observatory .....0  
 University Observatory .....0 AP

**\*PADOVA, Italy.**

Osservatorio Astronomico della R. Università .....0

PADUA, Italy. (See PADOVA.)

**\*PALERMO, Italy.**

R. Osservatorio Astronomico .....0 Met

PARC SAINT MAUR, France. (See PARIS.)

**PARIS, France.**

Bureau Central Météorologique de France.....Mag Met  
 \*Observatoire d'Astronomie Physique de Meudon .....AP  
 Observatoire Magnétique annexe du Val Joyeux.....Mag  
 Observatoire de Météorologie Dynamique de Trappes.....Met  
 \*Observatoire Municipal de Paris (Montsouris).....Met  
 \*Observatoire du Parc Saint Maur .....Mag Met  
 \*Observatoire de Paris .....0 Mag Met  
 Observatoire de la Tour St. Jacques.....Met

**PARMA, Italy.**

R. Osservatorio Astronomico e Meteorologico .....Met  
 R. Osservatorio Meteorologico e Geodinamico.....Met

PARSONSTOWN, Ireland. (See BIRR.)

**PATAGONES, Argentine Republic.**

Observatorio Meteorológico del Colegio Salesiano .....Met

**PAVIA, Italy.**

R. Osservatorio Meteorologico e Geodinamico.....Met

**PAVLOVSK, Russia.**

Magnetisches und Meteorologisches Observatorium (under Di-  
 rection of the Central Physical Observatory. St. Peters-  
 burg) .....Mag Met

**PAYSANDÚ, Uruguay.**

Observatorio Meteorológico del Colegio Salesiano .....Met

**PEKIN, China.**

Imperial College Observatory.  
 Observatory of the Imperial Russian Embassy .....Mag Met

**PERPIGNAN, France.**

Observatoire Météorologique Magnétique .....Mag Met

**PERTH, Western Australia.**

Government Observatory .....O Met

**PERUGIA, Italy.**

Osservatorio Meteorologico dell' Università.....Met

**PIC DU MIDI, France. (See BAGNÈRES-DE-BIGORRE.)****PISA, Italy.**

R. Osservatorio Meteorologico .....O Met

**PLONSK, Russia. (See VARSHAVA.)****\*POLA, Austria-Hungary.**

Marine-Sternwarte .....O Mag Met

**PONTA DELGADA (St. Michael), Azores.**

Observatorio Meteorologico .....Met

**POONA, India.**

Takhtasingji Observatory .....O AP

**\*PORT LOUIS, Mauritius.**

Royal Alfred Observatory .....O Mag Met

**PORTO, Portugal.**

Observatorio meteorologico "Princesa Dona Amelia.".....Met

**PORTO ALEGRE, Brazil.**

Observatorio Meteorologico .....Met

**POTSDAM, Germany.**

\*Königliches Astrophysikalisches Observatorium .....O AP

Königliches Geodätisches Institut .....O

Königliches Meteorologisches und Magnetisches Observa-  
torium .....Mag Met**PRAG, Austria-Hungary.**

\*K. K. Universitäts-Sternwarte .....O

Magnetic and Meteorological Observatory .....Mag Met

**PRZEMYSL (Galicia), Austria-Hungary.**

Private Observatory of Herr Trattnig.....O

**PUEBLA, Mexico.**

Observatorio Meteorológico del Colegio del Estado.....Met

**\*PULKOVO, Russia.**

Nikolaiefskaia Glavnaia Observatoria .....O AP

**SIDMOUTH, England.**

Private Observatory of Mr. Lindemann.

**SIENA, Italy.**

R. Osservatorio Meteorologico della Università.....Met

**SIMLA, India.**

Meteorological Office .....Met

**SOFIA, Bulgaria.**

Station Centrale Météorologique .....Met

**SONNBLICK (Salzburg), Austria-Hungary.**

Wetterwarte .....Met

**SOUTH KENSINGTON (London), England.**

Solar Physics Observatory .....AP

**SOUTHPORT, England.**

Fernley Meteorological Observatory .....Met

Observatory of Mr. J. Baxendell .....O AP

**SRINAGAR, Kashmir, India.**

Kashmir State Observatory .....Met

**STARFIELD, England. (See CROWBOROUGH.)****STEINAMANGER, Austria-Hungary. (See HERÉNY.)****STOCKHOLM, Sweden.**

Meteorologiska Central-Anstalten .....Met

\*Observatorium .....O

**STONYHURST, England. (See WHALLEY.)****STRASSBURG, Germany.**

\*Kais. Universitäts-Sternwarte .....O

Meteorologischer Landesdienst für Elsass-Lothringen.....Met

**STUTTGART, Germany. (See also KORNTHAL.)**

Königl. Meteorologische Central-Station .....Met

**\*SYDNEY, New South Wales.**

Government Observatory .....O Met

**\*TACHKENT (Turkestan), Russia.**

Observatoire Astronomique et Physique .....O AP Met

**\*TACUBAYA, Mexico.**

Observatorio Astronómico Nacional Mexicano .....O Mag Met



TAI-HO-KU, Formosa, Japan.

Central Observatory.

TAPADA, Portugal. (See LISBOA.)

TEGEL (near Berlin), Germany.

Aeronautical Observatory of the Prussian Meteorological

Institute .....Met

TERAMO, Italy.

Osservatorio Privato Cerulli .....O

Osservatorio Privato (G. Ciscato) .....AP

Osservatorio Privato di Collurania .....O

TIFLIS, Russia.

Tiflisskaia Fizicheskaia Observatoria .....AP Mag Met

TOKYO, Japan.

\*Astronomical Observatory of the Imperial University.....O

Central Meteorological Observatory .....Mag Met

Naval Observatory, Hydrographic Office .....Met

TOLUCA, Mexico.

Red Meteorológica del Estado de Mexico (Apartado Postal 29).Met

\*TORINO, Italy. (See also COURGNÉ and FOGLIZZO.)

Reale Osservatorio dell' Università .....O Met

TORONTO, Canada.

Meteorological Office .....Met

Observatory at Agincourt (part of the Meteorological Service  
of Canada) .....Mag Met

\*Toronto Observatory .....O

TOULON, France.

Observatoire de la Marine .....Mag

\*TOULOUSE, France.

Observatoire de Toulouse .....O AP Mag Met

TOW LAW, England. (See WOLSINGHAM.)

TRAPPES, France. (See PARIS.)

TREVANDRUM, India.

His Highness the Maharajah's Observatory .....Mag Met

TRIESTE, Austria-Hungary.

\*K. K. Astronomisch und Meteorologisches Observatorium.O Met  
Sternwarte des Herrn Krieger.

**TRINCOMALEE, Ceylon.**

Private Observatory .....O

**TSINTAU, Shantung, China.**

Meteorologisches Observatorium .....Met

**\*TULSE HILL (London S. W.), England.**

Observatory of Sir William Huggins.....AP

**TUNBRIDGE WELLS, England.**

Private Observatory of Mr. F. McClean.....AP

**TURIN, Italy. (See TORINO.)****UCCLE, Belgium. (See BRUXELLES.)****UPSALA, Sweden.**

\*Astronomiska Observatoriet .....O AP

Meteorologiska Institutionen .....Met

**UTRECHT, Netherlands.**

Koninklijk Nederlandsch Meteorologisch Instituut ....Mag Met

\*Sterrewacht Zonnenburg .....O

**VALENCIA, Ireland.**

Observatory of the London Meteorological Office .....Met

**VALKENBURG, Netherlands.**

Observatory of Ignatius College .....O

**VARSHAVA, Russia.**

\*Astronomicheskaja Observatoria .....O

Biuro Centralne Sieci Stacyj Meteorologicznych (Krakowskie-  
przedmieście, 66) .....Met

Obserwatorium Astronomiczne Imienia Dra Jędrzejewicza  
(Mokotowska, 6) .....O

**VENEZIA, Italy.**

\*Osservatorio dell' Istituto Nautico .....O AP

Osservatorio Meteorologico del Seminario Patriarcale .....Met

**VENICE, Italy. (See VENEZIA.)****VENTOUX (Mont), France. (See AVIGNON.)****VERONA, Italy.**

Osservatorio dell' Istituto Tecnico .....Mag Met

**VESUVIUS, Italy. (See NAPOLI.)****VIEDMA, Argentine Republic.**

Observatory .....Met

- VIENNA, Austria-Hungary. (See WIEN.)
- WÄHRING, Austria-Hungary. (See WIEN.)
- WALDENBURG, Germany. (See HERMSDORF.)
- WARSAW, Russia. (See VARSHAVA.)
- \*WELLINGTON, New Zealand.  
Colonial Observatory .....Met
- \*WHALLEY, England.  
Stonyhurst College Observatory .....AP Mag Met
- WIEN, Austria-Hungary.  
\*Die von Kuffner'sche Sternwarte .....O  
K. K. Central-Anstalt für Meteorologie und Erdmagnetis-  
mus .....Mag Met  
\*K. K. Universitäts-Sternwarte in Währing .....O AP  
Sternwarte der Technischen Hochschule .....O  
Sternwarte des Barons von Rothschild.  
Sternwarte des K. K. Militär-Geographischen Instituts.
- \*WILHELMSHAVEN, Germany.  
Kaiserliches Marine-Observatorium .....O Mag Met
- \*WINDSOR, New South Wales.  
Private Observatory of Mr. John Tebbutt .....O
- WOLFENBÜTTEL, Germany.  
Meteorological Observatory .....Met
- WOLSINGHAM, England.  
Private Observatory of Reverend T. E. Espin.....O AP
- YAMAGUCHI, Japan.  
Magnetic Observatory .....Mag
- YEKATERINBOORG, Russia. (See KATHARINENBURG.)
- ZACATECAS, Mexico.  
Observatorio Astronómico Meteorológico .....O Met
- ZI-KA-WEI, China. (See SHANGHAI.)
- ZUGSPITZE, Germany.  
Königlich Bayerische Meteorologische Station (Branch of  
Central Station, München) .....O Met
- ZURICH, Switzerland.  
Meteorologische Central-Anstalt .....Met  
\*Sternwarte des Eidg. Polytechnikums .....O AP Met



## INDEX OF TITLES

adie, Antoine, 23  
 as, Franklin, 27  
 nautical (Prussian Meteorological Institute), 35  
 ma University, 13  
 n College, 5  
 d University, 5  
 henry, 5  
 henry College, 10  
 erst College, 5  
 r Engineer School, 13  
 ophysical (Smithsonian Institution), 13

gardt, B. R., 10  
 ndell, J., 34  
 l, R. R., 11  
 i, 23  
 ii, 19  
 t College, 6  
 Nevis, 21  
 diktiner-Stift, 25  
 erside, 23  
 Castle, 17  
 offsheim, 17, 28, 29  
 burn University, 6  
 Hill, 9  
 ner, Charles G., 13  
 on University, 6  
 ell, 8  
 nic Gardens, 22  
 loin College, 6  
 i, 28  
 n University, 12  
 tel College, 5  
 nell University, 10  
 w, Kammerherr von, 17  
 er College, 9

ornia, University of (Berkeley, Cal.), 6  
 ornia, University of (Mount Milton, Cal.), 10  
 ridge, 18  
 idoglio, 32  
 ton College, 11  
 Franzens-Universität, 22  
 er, 29

Carlo Alberto, 28  
 Case School, 7  
 Catholic University of America, 13  
 Cerulli, 35  
 Chabot, 11  
 Chamberlin, 13  
 Charles Smith Scott, 11  
 Charleston College, 7  
 Chicago, University of (Chicago, Ill.), 7  
 Chicago, University of (Williams Bay, Wis.), 14  
 Cincinnati, 7  
 Ciscato, G., 35  
 Clark, 10  
 Clarke, 14  
 Coast and Geodetic Survey, 5, 7, 12, 24  
 Colaba, 17  
 Colby College, 14  
 Collurania, 35  
 Colorado College, 7  
 Colorado University, 6  
 Columbia University, 11  
 Common, Dr. A. A., 21  
 Cooper, Col., 27  
 Cornell University, 9  
 Creighton College, 11  
 Crossley, Edward, 23

Dakota University, 10  
 Daniel Scholl, 10  
 Danske Institut, 25  
 Dartmouth College, 9  
 Davidson, 12  
 Dawson, William, 12  
 Dearborn, 8  
 Denver, University of, 13  
 Detroit, 5  
 Dickinson College, 7  
 Doane College, 8  
 Drake University, 8  
 Dubuque, 8  
 Dudley, 5  
 Dunsink, 21

Earlham College, 12  
 Edgecomb, D. W., 11

- Elmira College, 8  
 Emerson McMillan, 7  
 Engelhardt, 24  
 Engineer School, U. S. A., 13  
 Erskine College, 8  
 Espin, T. E., 37  
 Ewell, Marshall D., 8  
  
 Fernley, 34  
 Field Memorial, 14  
 Flammarton, 17, 24  
 Flower, 11  
 Fort Worth University, 8  
 Franklin and Marshall College, 10  
 Franzens-Universität, 24  
  
 Galatz-Privat, 22  
 Georgetown University, 13  
 German Colonies, East Coast of Africa, 20  
 Gianicolo, 32  
 Glasgow University, 22  
 Goodall, 7  
 Goodsell, 11  
 Green, John C., School of Science, 12  
 Gregg, W. T., 6  
 Guenat, Herr, 22  
 Gurley, 10  
  
 Halsted, 12  
 Hamilton College, 7  
 Hanover College, 9  
 Harvard College, 6, 15  
 Haverford College, 9  
 Haynald, 24  
 Hess, F., 8  
 High School, Battle Creek, 6  
 High School, Philadelphia, 11  
 Holden, 13  
 Hooper, John R., 5  
 Hopkins (Johns) University, 5  
 Huggins, Sir William, 36  
 Hyatt Memorial, 7  
 Hygiene Municipal Office, 24  
  
 Ignatius College, 7, 36  
 Illinois. University of, 13  
 Illinois Wesleyan University, 6  
 Indiana, 6  
 "Infante Dom Luiz," 26  
 International Latitude, 8  
 Iowa College, 9  
 Iowa State University, 9  
 Iowa University.(Upper), 8  
  
 Jacks-Goodall, 7  
 Janssen, 28  
 Jedrzejewicza, 36  
 Jefferson and Washington College, 13  
 John C. Green School of Science, 12  
 Johns Hopkins University, 5  
 Josephs-Polytechnicum, 18  
  
 Kansas State University, 10  
 Kenyon College, 9  
 Kew, 32  
 Khédivial, 18  
 Kirkwood, 6  
 Knox College, 9  
 Krieger, Herr, 35  
 Kuffner'sche, 37  
  
 Laboratorio Quimico Central Casa de Moneda, 23  
 Ladd, 12  
 Lafayette College, 8  
 Landesregierung für Bosnien und Herzegovina, 33  
 Landwirthschaftliche Institut, 28  
 Landwirthschaftliche Landesmittelschule, 20  
 Latitude, International, 8  
 Lawrence (Amherst), 5  
 Lawrence University, 5  
 Laws, 7  
 Leander McCormick, 13  
 Lehigh University, 12  
 Lenox College, 9  
 Leopold-Franzens-Universität, 24  
 Lick, 10  
 Lindemann, 34  
 Litchfield, 7  
 London Meteorological Office, 36  
 Lowe, 8  
 Lowell, 8  
  
 McClean, F., 36  
 McClure, R. H., 10  
 McCormick, Leander, 13  
 McFarlane, R. W., 7  
 McGill University, 28  
 McKim, 9  
 McMillan, Emerson, 7  
 McMinnville College, 10  
 Magnetic, Trigonometrical and Photoheliographic Survey of India, 20  
 Maine University, 11

- Manora, 27  
 Mare Island, 10  
 Marietta College, 10  
 Marina, 32  
 Martin, Eugene, 14  
 Maw, W. H., 29  
 Meikleham, William, 12  
 Michigan State Agricultural College, 10  
 Michigan State Normal School, 14  
 Michigan, West, College, 9  
 Midland College, 5  
 Militar Geographisches Institut, 37  
 Military Academy, 14  
 Mills, Henry, 6  
 Minnesota University, 10  
 Minton, 6  
 Mississippi, University of, 13  
 Missouri State University, 7  
 Monrepos, 22  
 Morgan, 5  
 Morrison, 9  
 Morskala, 25, 29  
 Mount Holyoke College, 12  
 Mount Union College, 5  
  
 National Normal University, 30  
 National Physical Laboratory, 32  
 Naturforschende Gesellschaft, 20  
 Nautico, 36  
 Naval, 13, 26, 35  
 Naval Academy, 5  
 Navigations-Schule, 17, 21, 26  
 Navy Department, Brazil, 32  
 Nebraska, University of, 10  
 Neutralthaler Landwirthschaftlicher Verein, 15  
 Newall, H. F., 18  
 Newbegin, Mr., 29  
 Newton, 10  
 New York Meteorological, 11  
 Nicolaiefskaia Glavnaia, 31  
 Niederlandisches Institut, 15  
 Normal University, 10  
 Northwestern University, 8  
 Notre Dame University, 11  
 Numsen, W. H., 5  
  
 Ohio State University, 7  
 Ohio Wesleyan University, 8  
 Olney, 6  
  
 Pacific, University of, 7  
 Park College, 11  
 Parkhurst, H. M., 6  
  
 Peek, Sir Cuthbert, 27  
 Pennsylvania College, 9  
 Pennsylvania Military College, 7  
 Pennsylvania, University of, 11  
 Perkins, 8  
 Philadelphia, 11  
 Pio IX de Artes y Oficios-Almagro, 18  
 Pitts, Sullivan, 5  
 Plyer, Charles W., 8  
 Polytechnic Institute, 6  
 Pomona, 7  
 Prieur  de St. Jean, 22  
 "Prinzeza Dona Amelia," 31  
 Prussian Meteorological Institute, 35  
  
 Queen's College, 16, 20  
 Queen's University, 25  
  
 Radcliffe, 30  
 Remels, 16  
 Rensselaer Polytechnic Institute, 13  
 Roberts, A. W., 26  
 Roberts, Dr. Isaac, 20  
 Rockwell, Charles H., 13  
 Romano, Collegio, 32  
 Rotch, A. L., 9  
 Rothschild, Baron von, 37  
 Rutgers College, 11  
  
 S chsisches Institut, 19  
 Saint Louis, 33  
 Saint Xavier's College, 18  
 Salesiano Collegio, 20, 21, 30, 32  
 San Vincent, 23  
 Santa Clara College, 12  
 Sawyer, E. F., 6  
 Sayre, 12  
 Scholl, Daniel, 10  
 Scott, Charles Smith, 11  
 Scottish Meteorological Society, 21  
 Seagrave, 12  
 Seismological Society, 25, 28, 29, 31  
 Shaffer, Col. A. W., 12  
 Shannon, 14  
 Shattuck, 9  
 Smith (Beloit, Wis.), 6  
 Smith (Geneva, N. Y.), 9  
 Smith College, 11  
 Smithsonian Institution, Astrophysical, 13  
 Solar Physics, 25, 34  
 Stahn, Justice, 5

- Starfield, 20  
 Statistisches Amt, 33  
 Stockwell, John N., 7  
 Stonyhurst College, 37  
 Students' (Berkeley, Cal.), 6  
 Students' (Chicago, Ill.), 7  
 Surveyor General's Office, 19  
 Swarthmore College, 12  
 Swasey & Warner, 7  
 Syracuse University, 13  
 Szkoly, C. K., 27
- Takhtasingji, 31  
 Tarrant, J. K., 18  
 Taylor University, 13  
 Tebbutt, John, 37  
 Telegraph Department, 20, 32  
 Tellurisches, 16  
 Temple, 32  
 Terby, Dr. François, 26  
 Theodore Hyatt Memorial, 7  
 Timeball and Meteorological, 23  
 Tour St. Jacques, 30  
 Trattnig, 31  
 Trinity College, 9, 21  
 Tulane University, 11
- Underwood, 5  
 United States Army Engineer School, 13  
 United States Coast and Geodetic Survey, 5, 7, 12, 24  
 United States Military Academy, 14  
 United States Naval, 13  
 United States Naval Academy, 5  
 United States Weather Bureau, 13, 23, 25  
 Upper Iowa University, 8  
 Urania, 16
- Val Joyeux, 30  
 Vallot, 28  
 Vanderbilt University, 11  
 Vassar College, 12  
 Vaticana, 32  
 Vesuviano, 29  
 Villa Colon, 28  
 Virginia, University of, 13
- Wake Forest College, 13  
 Ward, James W., 6  
 Warner, 12  
 Warner & Swasey, 7  
 Washburn, 10  
 Washington and Jefferson College, 13  
 Washington University, (St. Louis, Mo.), 12  
 Washington, University of (Seattle, Washington), 12  
 Weather Bureau, 13, 23, 25  
 Wellesley College, 14  
 Wesleyan University, 10  
 West Michigan College, 9  
 Western Reserve University, 7  
 Whitin, 14  
 Williams College, 14  
 Williams, Stanley A., 18  
 Wilmington College, 14  
 Wilson, W. E., 20  
 Winchester, 11  
 Wisconsin, University of, 10  
 Wooster, University of, 14
- Ximeniano, 21
- Yale University, 11  
 Yankton College, 14  
 Yerkes, 14
- Zonnenburg, 36



# INDEX OF LOCALITIES

## UNITED STATES

### ALABAMA.

University, 13

### ALASKA

Sitka, 12

### ARIZONA

Flagstaff, 8

### CALIFORNIA

Berkeley, 6

Claremont, 7

College Park, 7

Echo Mountain, 8

Los Angeles, 10

Mare Island, 10

Mount Hamilton, 10

Oakland, 11

San Francisco, 12

Santa Clara, 12

### COLORADO

Boulder, 6

Colorado Springs, 7

University Park, 13

### CONNECTICUT

Hartford, 9

Middletown, 10

New Haven, 11

Newington, 11

### DISTRICT OF COLUMBIA

Washington, 13

### ILLINOIS

Bloomington, 6

Carlinville, 6

Chicago, 7

Evanston, 8

Galesburg, 9

Urbana, 13

### INDIANA

Bloomington, 6

Greencastle, 9

Hanover, 9

Irvington, 9

Notre Dame, 11

Richmond, 12

Spiceland, 12

Upland, 13

Vevay, 13

### IOWA

Des Moines, 8

Dubuque, 8

Fayette, 8

Fort Dodge, 8

Grinnell, 9

Hopkinton, 9

Iowa City, 9

Pella, 11

### KANSAS

Atchison, 5

Baldwin, 5

Lawrence, 10

### LOUISIANA

New Orleans, 11

### MAINE

Brunswick, 6

Orono, 11

Waterville, 14

### MARYLAND

Annapolis, 5

Baltimore, 5

Cheltenham, 7

Gaithersburg, 8

### MASSACHUSETTS

Amherst, 5

Boston, 6

Cambridge, 6

Cambridgeport, 6

Hyde Park, 9

Northampton, 11

South Hadley, 12

Wellesley, 14

Williamstown, 14

### MICHIGAN

Albion, 5

Ann Arbor, 5

Battle Creek, 6

Grand Rapids, 9

Lansing, 10

Ypsilanti, 14

**MINNESOTA**

Minneapolis, 10  
Northfield, 11

**MISSISSIPPI**

University, 13

**MISSOURI**

Columbia, 7  
Glasgow, 9  
Parkville, 11  
Saint Louis, 12

**NEBRASKA**

Crete, 8  
Lincoln, 10  
Omaha, 11

**NEW HAMPSHIRE**

Hanover, 9

**NEW JERSEY**

Elizabeth, 8  
New Brunswick, 11  
Princeton, 12

**NEW YORK**

Albany, 5  
Alfred, 5  
Brooklyn, 6  
Buffalo, 6  
Clinton, 7  
Elmira, 8  
Geneva, 9  
Ithaca, 9  
New York, 11  
Poughkeepsie, 12  
Riverdale, 12  
Rochester, 12  
Syracuse, 13  
Tarrytown, 13  
Troy, 13  
West Point, 14

**NORTH CAROLINA**

Raleigh, 12  
Wake Forest, 13  
Wilmington, 14

**OHIO**

Akron, 5  
Alliance, 5  
Barnesville, 6  
Cincinnati, 7  
Cleveland, 7

Columbus, 7

Delaware, 8

Gambier, 9

Lebanon, 10

Linwood, 10

Marietta, 10

Wilmington, 14

Wooster, 14

**OREGON**

McMinnville, 10

**PENNSYLVANIA**

Allegheny, 5

Carlisle, 7

Chester, 7

Easton, 8

Gettysburg, 9

Haverford, 9

Lancaster, 10

Lewisburg, 10

Meadville, 10

Philadelphia, 11

South Bethlehem, 12

Swarthmore, 13

Washington, 13

**RHODE ISLAND**

Providence, 12

**SOUTH CAROLINA**

Charleston, 7

Due West, 8

**SOUTH DAKOTA**

Mitchell, 10

Yankton, 14

**TENNESSEE**

Nashville, 11

**TEXAS**

Fort Worth, 8

**VIRGINIA**

University of Virginia, 13

**WASHINGTON**

Seattle, 12

**WISCONSIN**

Appleton, 5

Beloit, 6

Madison, 10

Williams Bay, 14

# FOREIGN

## AFRICA, EAST COAST

Dar-es-Salam, 20

## ALGERIA

Alger, 15

Bourzareah, 15

## ANGOLA (Africa)

Loanda, 26

## ARGENTINE REPUBLIC

Bernal, 16

Buenos Aires, 18

Camen de Patagones, 18

Chubut, 19

Cofdoba, 20

La Plata, 25

Nicolas de los Arrojo, 29

Patagones, 30

Viedma, 36

## AUSTRIA-HUNGARY

Alt Krasne, 15

Bosnia, 33

Budapest, 18

Carlsburg, 19

Czernowitz, 20

Graz, 22

Herény, 23

Herzegovina, 33

Innsbruck, 24

Kalocsa, 24

Krakow, 25

Kremsmünster, 25

Lussinpiccolo, 27

Lwówie, 27

Obir, 29

Ó-Gyalla, 29

Pola, 31

Prag, 31

Przemysl, 31

Sarajevo, 33

Sonnblick, 34

Trieste, 35

Wien, 37

## AZORES

Ile Terceira, 24

Ponta Delgada, 31

St. Michael, 31

## BELGIUM

Bruxelles, 18

Liège, 26

Louvain, 26

## BRAZIL

Curityba, 20

Cuyabá, 20

Juiz de Fora, 24

Porto Alegre, 31

Quixeramobim, 32

Rio de Janeiro, 32

Sao Paulo, 33

## BRITISH GUIANA

Georgetown, 22

## BULGARIA

Sofia, 34

## CANADA

Agincourt, 35

Kingston, 25

Montreal, 28

Quebec, 32

Toronto, 35

## CAPE COLONY

Cape Town, 18

Kimberley, 25

Lovedale, 26

## CEYLON

Colombo, 19

Trincomalee, 36

## CHILE

Punta Arenas de Magellanes,  
32

Santiago, 33

## CHINA

Hien-Hien, 23

Hongkong, 24

Pekin, 30

Shanghai, 33

Tchang-kai-tchonang, 23

Tsintau, 36

Zô-is, 33

## COCHIN-CHINA (FRENCH)

Saigon, 32

## COLOMBIA

Bogotá, 17

## COSTA RICA

San José, 33

## CUBA

Belen, 23

Habana, 23

**DENMARK**

Kjöbenhavn, 25

**ECUADOR**

Guayaquil, 23

Quito, 32

San Vincent, 23

**ENGLAND**

Birkenhead, 26

Brighton, 18

Bushey Heath, 18

Cambridge, 18

Crowborough, 20

Durham, 21

Ealing, 21

Falmouth, 21

Greenwich, 22

Halifax, 23

Jersey, 33

Kew, 24

Lancaster, 25

Liverpool, 26

London, 26

Lyme Regis, 27

Norwich, 29

Outwood, 29

Oxford, 30

Richmond, 32

Rugby, 32

Saint Hélier, 33

Sidmouth, 34

South Kensington, 34

Southport, 34

Tulse Hill, 36

Tunbridge Wells, 36

Whalley, 37

Wolsingham, 37

**EGYPT**

Cairo, 18

**FINLAND***See Russia***FRANCE**

Avignon, 16

Bagnères-de-Bigorre, 16

Besançon, 17

Beul, 17

Bordeaux, 17

Brest, 17

Cherbourg, 19

Clermont-Ferrand, 19

Grignon, 22

Hendaye, 23

Juvisy, 24

Lorient, 26

Lyon, 27

Marseille, 27

Mont Aigoual, 28

Mont Blanc, 28

Mont Mournier, 28

Montpellier, 28

Mont-Ventoux, 16

Nantes, 28

Nice, 29

Orthez, 29

Paris, 30

Perpignan, 31

Petit Port, 28

Pic du Midi, 16

Rochefort, 32

Toulon, 35

Toulouse, 35

**GERMANY**

Aachen, 15

Altenburg, 15

Bamberg, 16

Berlin, 16

Beuthen, 17

Böckum, 17

Bogenhausen, 17

Bonn, 17

Bothkamp, 17

Bremen, 17

Breslau, 17

Chemnitz, 19

Clausthal, 19

Danzig, 20

Dresden, 20

Düsseldorf, 21

Elsass-Lothringen, 34

Elsfleth, 21

Frankfurt am Main, 22

Geisenheim, 22

Gohlis, 22

Gotha, 22

Göttingen, 22

Halle an der Saale, 23

Hamburg, 23

Heidelberg, 23

Hermendorf, 23

Jena, 24

Karlsruhe, 24

Kiel, 25

Königsberg, 25

Kornthal, 25

Leipzig, 26

Lübeck, 26

Magdeburg, 27

Marburg, 27  
München, 28  
Nürnberg, 29  
Potsdam, 31  
Schwerin, 33  
Strassburg, 34  
Stuttgart, 34  
Tegel, 35  
Wilhelmshaven, 37  
Wolfenbüttel, 37  
Württemberg, 25  
Zugspitze, 37

GREECE

Athens, 15

GUATEMALA

Guatemala, 23

HAWAIIAN ISLANDS

Honolulu, 24

INDIA

Allahabad, 15  
Bangalore, 16  
Bombay, 17  
Calcutta, 18  
Dehra Dun, 20  
Jaipur, 24  
Kashmir, 34  
Kodaikanal, 25  
Mysore, 16  
Oudh, 15  
Poona, 31  
Simla, 34  
Srinagar, 34  
Trevandrum, 35

INDO-CHINA

Haiphong, 23  
Phu lien, 23

IRELAND

Armagh, 15  
Belfast, 16  
Birr, 17  
Cork, 20  
Daramona, 20  
Dublin, 21  
Dunsink, 21  
Markree, 27  
Valencia, 36

ITALY

Arcetri, 21  
Bologna, 17  
Capo di Monte, 29  
Catania, 19  
Collurania, 35

Courgné, 20  
Firenze, 21  
Foglizzo, 21  
Genova, 22  
Ischia, 24  
Milano, 28  
Modena, 28  
Moncalieri, 28  
Napoli, 29  
Padova, 30  
Palermo, 30  
Parma, 30  
Pavia, 30  
Perugia, 31  
Pisa, 31  
Rocca di Papa, 32  
Roma, 32  
Siena, 34  
Teramo, 35  
Torino, 35  
Venezia, 36  
Verona, 36

JAMAICA

Kingston, 25

JAPAN

Formosa, 35  
Kumamoto, 25  
Nagoya, 28  
Nemuro, 29  
Sendai, 33  
Tai-Ho-Ku, 35  
Tokyo, 35  
Yamaguchi, 37

JAVA

Batavia, 16

MADAGASCAR

Antananarivo, 15

MADEIRA

Funchal, 22

MAURITIUS

Port Louis, 31

MEXICO

Jalapa, 24  
Leon, 26  
Mexico, 27  
Oaxaca, 29  
Puebla, 31  
Tacubaya, 34  
Toluca, 35  
Vera Cruz, 24  
Zacatecas, 37

**NATAL**

Durban, 21

**NETHERLANDS**

Amsterdam, 15

Groningen, 23

Leiden, 26

Utrecht, 36

Valkenburg, 36

**NEW BRUNSWICK**

Saint John, 33

**NEW SOUTH WALES**

Sydney, 34

Windsor, 37

**NEW ZEALAND**

Auckland, 16

Wellington, 37

**NORWAY**

Bergen, 16

Christiania, 19

**PHILIPPINE ISLANDS**

Manila, 27

**PERU**

Arequipa, 15

**PORTUGAL**

Coimbra, 19

Lisboa, 26

Porto, 31

**QUEENSLAND**

Brisbane, 18

**ROUMANIA**

Bucuresci, 18

Galatz, 22

**RUSSIA**

Barnaul, 16

Charkow, 19

Derpt, 20

Helsingfors, 23

Irkutsk, 24

Katharinenburg, 24

Kazan, 24

Kharkoff, 25

Kief, 25

Kronstadt, 25

Moskva, 28

Nikolaieff, 29

Odessa, 29

Pavlovsk, 30

Pulkovo, 31

Sankt Peterburg, 33

Tachkent, 34

Tiflis, 35

Varshava, 36

**SAINT HELENA**

Saint Helena, 33

**SAN SALVADOR**

San Salvador, 33

**SCOTLAND**

Campbeltown, 27

Dun Echt, 21

Edinburgh, 21

Fort William, 21

Glasgow, 22

Machrihanish, 27

**SERVIA**

Belgrad, 16

**SIBERIA***See* RUSSIA**SOUTH AUSTRALIA**

Adelaide, 15

**SPAIN**

Madrid, 27

San Fernando, 33

**SWEDEN**

Lund, 27

Stockholm, 34

Upsala, 36

**SWITZERLAND**

Basel, 16

Berne, 16

Bernoullianum, 16

Genève, 22

Neuchâtel, 29

Zurich, 37

**SYRIA***See* TURKEY**TASMANIA**

Hobart, 23

**TURKEY**

Beirut, 16

Constantinople, 19

**URUGUAY**

Montevideo, 28

Paysandú, 30

**VENEZUELA**

Caracas, 18

**VICTORIA**

Melbourne, 27

**WESTERN AUSTRALIA**

Perth, 31

SMITHSONIAN MISCELLANEOUS COLLECTIONS

- 1312

INDEX TO THE LITERATURE  
OF THE  
SPECTROSCOPE

(1887-1900, BOTH INCLUSIVE)

[CONTINUATION OF THE PREVIOUS INDEX BY THE SAME AUTHOR  
PUBLISHED IN 1888]

BY

ALFRED TUCKERMAN



WASHINGTON CITY  
PUBLISHED BY THE SMITHSONIAN INSTITUTION

1902

**The Knickerbocker Press, New York**



## PREFACE.

IN this volume I have continued my Index to the Literature of the Spectroscope, Smithsonian Miscellaneous Collections No. 658 (published in 1888), to the end of the year 1900, after which date the International Committee for Indexing Scientific Literature begins the continuation of the work of cataloguing Spectroscopy. I have been obliged to leave Astronomical Spectroscopy incomplete, for want of space. In other respects I hope this second volume will be considered an improvement on the first.

ALFRED TUCKERMAN.

NEW YORK, Feb. 3, 1902.



# INDEX TO THE LITERATURE OF THE SPECTROSCOPE.

1887 TO 1900 (BOTH INCLUSIVE).

BY ALFRED TUCKERMAN.

## PART I.—AUTHOR-INDEX.

### A

- Abati, G.* Sul potere rifrangente e dispersivo del silicio. *Gazz. chim.* 27 (1897), 437-455; *Beibl.* (1898) 397.
- Abbé, C.* Observations of twilight and zodiacal light. *Nature* 38 (1889), 519-521; *Beibl.* (1890) 38.
- —. On the height of the aurora. *Proc. Amer. Phil. Soc.* (1898); *Nature* 58 (1898) 603; *Beibl.* (1899) 178.
- Abbot, Ch. G., and F. E. Fowle.* Longitudinal deviation in prisms. *Amer. J. Sci.* (4) 2 (1896) 255-257; *Beibl.* (1897) 407.
- Abetti.* Osservazioni dei satelliti di Giove. *Astron. Nachr.* 141 (1896) 134-135.
- Abney, W. deW., and E. Festing.* Intensity of radiation through turbid media. *Proc. Roy. Soc.* 40 (1886) 378-380; *Jahresb.* (1886) 288.
- — —. Colour photometry. *Phil. Trans.* 177 (1886) 423-456; 179 (1888) 547-570; 183 (1892) 521-566; *Beibl.* (1888) 340; (1889) 679.
- — —. The solar spectrum  $\lambda$  7150 to  $\lambda$  10000. *Phil. Trans.* 177 (1886) 459-469; *Beibl.* (1888) 351.
- — —. Transmission of sunlight through the earth's atmosphere. *Phil. Trans.* 179 II (1887) 251-283; 184 (1893) 1-42; *Beibl.* (1888) 350; (1895) 242.
- — —. Measurement of the luminosity and intensity of light reflected from coloured surfaces. *Phil. Mag.* (5) 27 (1889) 62-69.

- Abney, W. deW., and T. E. Thorpe.* Determination of the photometric intensity of the coronal light. *Proc. Roy. Soc.* 46 (1889) 354.
- — — and *G. S. Edwards.* Effect of the spectrum on the haloid salts of silver. *Proc. Roy. Soc.* 47 (1890) 249; *Jahresb.* (1890) 407.
- — —. Numerical registration of colours. *Proc. Roy. Soc.* 49 (1891) 227–233; 50 (1891) 369–372; *Beibl.* (1891) 512.
- — —. Limit of visibility of the various rays. *Proc. Roy. Soc.* 49 (1891) 509–521; *Beibl.* (1892) 741.
- — —. Sensitiveness of the eye to light and colour. *Nature* 47 (1893) 538–542; *Beibl.* (1893) 571.
- — —. Measurement of colour produced by contrast. *Proc. Roy. Soc.* 56 (1894) 221–229; *Beibl.* (1895) 179.
- — —. Photographs of flames. *Chem. News* 70 (1894) 10.
- — —. Note on photographing sources of light with monochromatic rays. *Proc. Roy. Soc.* 60 (1896) 13–15; *Beibl.* (1897) 981.
- — — and *T. E. Thorpe.* Determination of the photometric intensity of the coronal light. *Phil. Trans.* 186 (1896) part I; *Astrophys. J.* 4 (1896) 375.
- — —. Sensitiveness of the retina to light and colours. *Proc. Roy. Soc.* 61 (1897) 330; *Beibl.* (1898) 409.
- — —. Ueber die Zerlegung des Spektrums des elektrischen Lichtes in Leuchtkraftmengen von drei Farben. *Jahrb. f. Photogr.* (1899) 338–350.
- Acroyd, W.* Law of colour in relation to chemical constitution. *Chem. News* 65 (1892) 202–203, 205; *Beibl.* (1892) 534.
- — —. On the origin of colour. *Chem. News* 67 (1893) 27–28, 64, 111–112, 147; *Beibl.* (1893) 445; (1894) 756.
- Adeney, W. E., and J. Carson.* The great Rowland spectrometer in the Roy. University of Ireland. *Phil. Mag.* (5) 46 (1898) 223–227.
- Agafonoff, V.* Sur l'absorption du spectre ultraviolet par les corps cristallisés. *C.-R.* 123 (1896) 490–492; *Chem. News* 74 (1896) 204; *Beibl.* (1897) 227.
- — —. Comparison de l'absorption, par les milieux cristallisés, des rayons lumineux et des rayons Röntgen. *C.-R.* 124 (1897) 855–857; 125 (1897) 87–90; *Beibl.* (1898) 781.
- Aitken, R. G.* Variations in the spectrum of the Orion Nebula. *Astrophys. J.* 6 (1897) 365.
- Almy, J. E.* Accidental refraction in liquids. *Phil. Mag.* (5) 44 (1897) 499–503; *Beibl.* (1898) 156.

- Althausse, M.*, und *G. Kruess*. Beziehungen zwischen Zusammensetzung und Absorptionsspectrum organischer Verbindungen. Ber chem Ges 22 (1889) 2065-2070; Beibl (1889) 945.
- Ambrohn, H.* Das optische Verhalten markhaltiger und markloser Nervenfasern. Ber. sächs. Ges. d. Wiss. (1890) 419-429.
- —. Über den Glanz der Sapphirinen. Beibl. (1890) 990.
- —. Optische Eigenschaften sehr enger Spalten. Ann. Phys. n. F. 48 (1893) 717.
- Ames, J. S.* The Concave Grating in theory and practice. Phil. Mag. (5) 27 (1889) 369-384; Beibl. (1889) 673.
- — —. Relations between the lines of various spectra, with special reference to those of cadmium and zinc, and a redetermination of their wave-lengths. Phil. Mag. (5) 30 (1890) 33-48; Jahreshb. (1890) 397.—See Grunwald, Jahreshb. (1887) 344; Boisbaudran, Jahreshb. (1869) 174; Balmer, Jahreshb. (1885) 319.
- — —. Spectra of some gases, hydrogen and nitrogen. Phil. Mag. (5) 30 (1890) 48-58; Beibl. (1890) 1099.
- — —. Probable spectrum of sulphur. Astron. and Astrophys. 12 (1893) 50-51; Beibl. (1893) 827.
- — —. Rontgen's X Rays. Astrophys. J. 3 (1896) 294-295.
- — — and *W. J. Humphreys*. Note on the effect of pressure upon the series in the spectrum of an element. Johns Hopkins Univ. Cir. 16 (1897); Phil. Mag. 44 (1897) 119-122; Beibl. (1897) 974.
- — — and *R. F. Earhart*. Some notes on the Zeeman effect. Johns Hopkins Univ. Cir. 17 (1898); Beibl. (1898) 892.
- — —. Prismatic and Diffraction Spectra. New York, 1898, 68 pp., Harper & Bros; Astrophys. J. 9 (1899) 277-278, rev.
- Amster, J. S.* Zur Erklärung des Alpenglühens. Ztsch. phys. chem. Unterr. 8 (1895) 6, 319-320.
- Anderson, A.* Maximum deviation of a ray of light by a prism. Cambridge Proc. 9 (1896) 195-198.
- Anderson, T. D.* New variable star in Delphinus. Astron. Nachr. 139 (1895) 27-29.
- — —. New variable in Hercules. Astron. Nachr. 141 (1896) 104.
- — —. New variables in Andromeda; in Pegasus; in Hercules. Astron. Nachr. 139 (1895) 118-119. See Copeland, *ibid.* 115-117.
- — —. New variable in Lyra. Astron. Nachr. 139 (1896) 269.
- — —. New variables in Andromeda and Hercules. Astron. Nachr. 141 (1896) 419; 142 (1897) 159.

- Anderson W. Observations of the Leonids. *Mon. Not.* 17 (1890) 19-29.
- Anders E. Die Seeliger'sche Theorie des Saturnrings und der Beleuchtung der grossen Planeten überhaupt. *Astron. Nachr.* 131 (1888) 1-16.
- — — Ueber die Lichtvertheilung auf einer unvollständig beleuchteten Planetenscheibe. *Astron. Nachr.* 130 (1888) 377-388.
- — — Einfluss der Sternvertheilung auf die Bestimmung des Sonnenages nach der Bessel'schen Methode. *Astron. Nachr.* 130 (1888) 1-17.
- Anderson L. Some characteristics of the solutions of sulpho-uranide chromes. *Proc. Iowa Acad. Sci.* 1894 part 4, *Chem. News* 70 (1894) 163-166.
- Angström K. Sur une nouvelle méthode de faire des mesures absolues de la chaleur rayonnante. *Jahresb.* 1886/87: *Nova Acta Upsal.* 8 (1887) 1-17.
- — — Zur Strahlung von Wärme verschiedener Wellenlänge durch trockne Meilen. *Ann. Phys.* n. F. 36 (1889) 713-725.
- — — Nyare studier öfver det ultraröda spektrum. *Svensk Kemisk Tidskrift* 1889, 98-103. *Beibl.* 1891: 332. *Deilverd. Vet. Akad. Forh.* 45 (1890) 330-337, 47 (1890) 331-353.
- — — Beobachtung über die Strahlung der Sonne. *Bih. Svensk. Vet. Akad. Handl.* 15 (1889) No. 10 10 pp.
- — — L'intensité de la radiation des gaz sous l'influence de la décharge électrique. *Vet. Akad. Forh.* 48 (1891) 373-377.
- — — Bolometrische Untersuchungen über die Stärke der Strahlung verdünnter Gase unter dem Einflusse der elektrischen Entladung. *Verh. d. Ges. d. Wiss. Upsala* 9. April 1892, *Ann. Phys.* n. F. 48 (1893) 493.
- — — och Palmer. Le spectre infra-rouge du chlore et de l'acide chlorhydrique. *Stockholm Akad. Forh.* 50 (1893) 380-390.
- — — Bolometrische Arbeiten von Fr. Paschen. *Ann. Phys.* n. F. 52 (1894) 509.
- — — Bolometrische Untersuchungen. *Nov. Act. Upsala*, 1895.
- — — Einfache Methode zur photographischen Darstellung des infraroten Spektrums. *Nova Acta Upsala* (1895) 4 pp.; *Beibl.* (1896) 196.
- — — Absorptionsvermögen einer berussten Fläche. *Stockholm Akad. Forh.* 55 (1898) 283-295. *Beibl.* (1899) 97-98.
- Anonymous. Height of the Aurora. *Nature* 60 (1899) 130-133.
- — — Argon the newly discovered gaseous constituent of the atmosphere. *Chem. News* 70 (1894) 296.

- Antoniadi, E. M.* Auroræ of September 1894. Jour. But. A. 5 (1894) 106-107.
- — —. Nouvelles observations sur Jupiter. Bull. Soc. astron. de France 2 (1896) 28-30.
- — —. Saturne en 1895. Bull. Soc. astron. France 1 (1896) 271-273.
- — —. The Hour-Glass Sea on Mars. Knowledge 20 (1897) 169.
- Antrick, O.* Das optische Verhalten des Cocains. Ber. chem. Ges. (1887) 310.
- Archenhold, F. S.* Ein ausgedehnter Nebel bei  $\xi$  Persie. Beibl. (1893) 129.
- Arcinus, A.* The Great Madrid Meteor. Nature 53 (1896) 395.
- Arendt, Th.* Die Schwankungen im Wasserdampfgehalte der Atmosphäre auf Grund spektroskopischer Untersuchungen. Ann. Phys. n. F. 58 (1896) 171-204.
- Armstrong, H. E.* Origin of colour. Chem. News 65 (1892) 284; 66 (1892) 143, 155, 288, 297-300, 311-314; 67 (1893) 143-145, 255; Beibl. (1893) 206; (1894) 756.
- Arno, R.* Transparenz des Ebonits. Atti Accad. Torino (1892-1893) 414-416; Beibl. (1894) 455.
- — —. La radiazione di Röntgen con tubi di Hittorf ad hidrogens rarefatto. Atti Accad. Torino 31 (1895-1896) 418-421.
- Arrhenius, Sv.* Ueber den Einfluss der Sonnenstrahlung auf die elektrischen Erscheinungen in der Erdatmosphäre. Meteorol. Zetsch. (1888) 297-304.
- — —. Ueber den Einfluss der Kohlensäure in der Luft auf die Temperatur des Erdbodens. Beibl. (1896) 979; Verh. deutsch. Naturf. (1895); Phil. Mag. (5) 41 (1896) 237-276.
- — —. Einfluss des atmosphärischen Kohlensäuregehaltes auf die Temperatur der Erdoberfläche. Bih. Svensk. Akad. Handl. (1897) 102 pp; Beibl. (1897) 976.
- Aschkinass, E.* Absorptionsspektrum des flüssigen Wassers und über die Durchlässigkeit der Augenmedien für rote und ultrarote Strahlen. Ann. Phys. n. F. 55 (1895) 401-431.
- — —. Emission des Quarzes in dem Spektralbereich seiner metallischen Absorption. Verh. d. phys. Ges. Berlin 17 (1898) 101-105.
- Askénasy, P., und V. Meyer.* Photochemische Notizen. Liebig's Ann. 267 (1892) 72-74.
- Aubel, E. van.* Note sur la transparence du platine. Bull. Acad. Belg. (3) 11 (1886) 408-14; 12 (1886) 665; Jahresb. (1886) 288.
- — —. Ueber die Dichtigkeiten und Brechungsindices der Mischungen von Aldehyd und Aceton mit Wasser. Beibl. (1896) 195; de phys. 4 (1895) 478-482.

- Aubel, E. van.* Action du magnétisme sur les spectres des gaz. *J. de phys.* 7 (1898) 408.
- Amers, A.* Einfluss der Farbe der Blendgläser bei Messungen des Sonnendurchmessers. *Astron. Nachr.* 123 (1889) 97-104. *Beibl.* (1890) 787.
- — Bemerkung zu der deutschen Venusexpeditionen. *Beibl.* (1894) 763.
- Aymonnet, F.* Relation entre l'indice de réfraction d'un corps, sa densité, son poids moléculaire et son pouvoir diathermane. *C.-R.* 113 (1891) 418-421; *Beibl.* (1891) 430.
- — Sur les maxima périodiques des spectres. *C.-R.* 114 (1892) 582-685, 117 (1893) 304-306, 402-405, 123 (1896) 645-658. *Beibl.* (1893) 336.
- — Sur les radiations calorifiques comprises dans la partie lumineuse d'un spectre. *C.-R.* 119 (1894) 50-53, 151-154. *Beibl.* (1894) 908; (1895) 64.
- — Sur le déplacement spectral du maximum calorifique solaire. *C.-R.* 121 (1895) 1139-1141, *Beibl.* (1896) 537; *Chem. News* 20 (1896) 47.
- Ayrton, W. E., and E. A. Medley.* Tests of glow lamps. *Phil. Mag.* (5) 39 (1895) 389-422.

## B

- Bacci, P.* Sullo spettro di assorbimento dei gas, con tavole. *Mem. Spettr. Ital.* 28 (1899) 97-102, 121-129; *Beibl.* (1899) 635-636.
- Buckhouse, T. W.* Variable Orange Stars. *Observatory* 18 (1895) 94.
- — Zodiacal Light. *Jour. B. A. A.* 5 (1895) 307.
- — New Variable Orange Stars. *Observ.* 19 (1896) 160-161.
- — Photograph of "Flash" Spectrum. *Astrophys. J.* 8 (1898) 198.
- Backlund, O.* Comet Encke. *Mem. Acad. St. Petersburg.* (7) 34 (1886) 41 pp.
- Bailey, G. H.* Absorption spectra of rare earths. Didymium. *Rept. Brit. Assoc.* (1887) 568-572, 654-655; *Beibl.* (1888) 194; (1889) 815. See G. Kruss und L. F. Nilson. *Ber. chem. Ges.* 20 (1887) 3067-3072.
- Bailey, S. I.* Catalogue of 7922 Southern Stars observed with the Meridian Photometer, 1889-91. *Ann. Harv. Observ.* 34 (1895) 1-259.
- — Periods of variable stars. *Astrophys. J.* 10 (1899) 255-265.



- Baily, E. C.*, and *M. W. Travers*. Helium in the Atmosphere. *Nature* 58 (1898) 545.
- Baily, W.* On the construction of a colour map. *Phil. Mag.* (5) 33 (1892) 496-503; *Chem. News* 65 (1892) 202.
- Baldock, J. H.*, and *Road, A.* A comparison of the spectroscopic and photographic examination of dark-room illumination. *Brit. J. Photogr.* (1895) 805-806.
- Baldann, Caroline W.* Strontium Lines. *Phys. Rev.* 3 (1895-1896) 452.
- . A photographic study of arc spectra. *Phys. Rev.* 3 (1896) 370-380, 448-458, *Beibl.* (1896) 774.
- Bull, L. de.* Anzeige eines neuen veränderlichen Sterns B. D.—<sup>o</sup>6.541 6 in Aquila. *Astron. Nachr.* 137 (1895) 73-74.
- Balmer, J. J.* Eine neue Formel für Spektralwellen. *Ann. Phys. n.* F 60 (1897) 380-391, *Astrophys. J.* 5 (1897) 199-209.
- Baly, E. C. C.* A possible explanation of the twofold spectra of oxygen and nitrogen. *Proc. Roy. Soc.* 57 (1895) 468-469; *Chem. News* 71 (1895) 169-170.
- Bancroft, W. D.* Note on the transference number of hydrogen. *J. physical Chem.* 2 (1898) 496-498.
- Bandrowski, E.* Ueber Lichterscheinungen während der Krystallisation. *Z. physical Chem.*, 15 (1894) 323-326; 17 (1895) 234-235; *Beibl.* (1895) 495.
- Barbier, Ph.*, et *L. Roux*. Recherches sur la dispersion dans les composés organiques (éthers-oxvdes). *C.-R.* 108 (1889) 1249; 110 (1890) 457-460, 527, 1071; 111 (1890) 180-183, 235-236; 112 (1891) 582-584; *Jahresb.* (1889) 315; (1890) 390-392; *Beibl.* (1891) 556.
- Bardetscher, G. A.* Einfluss der Temperatur auf Phosphorescenzerscheinungen. *Diss. Bern*, 1889; *Beibl.* (1892) 742.
- Barnard, E. E.* Physische und mikrometrische Beobachtungen der Begleiter des Cometen 1889 V. *Astron. Nachr.* 125 (1890) 177-196.
- . Beobachtungen der Venus nahe ihrer unteren Conjunction. *Astron. Nachr.* 120 (1891) 295-296; *Beibl.* (1891) 645.
- . Photograph of Swift's Nebula in Monoceros N. G. 2237. *Astron. and Astrophys.* 13 (1894) 642-644.
- . The great red spot and other markings on Jupiter. *Astron. and Astrophys.* 13 (1894) 736.
- . The exterior nebulosities of the Pleiades. *Astron. and Astrophys.* 13 (1894) 768-770; *Astron. Nachr.* 136 (1894) 196.
- . Photograph of M. 8 and the Trifid Nebula. *A and A.* (1894) 791.

- Barnard, E. E. (Cont'd.). The Great Photographic Nebula of Orion. *A. and A.* (1894) 511-514.
- — — and Perry, F. C. Structure of the Milky Way. *Knowledge* 17 (1894) 253.
- — —. The new Merope Nebula. *Astron. Nachr.* 139 (1895) 41-43.
- — —. New planetary nebula. *Astron. Nachr.* 139 (1895) 43.
- — —. Photograph of the Nebula N. G. C. 1499, near the star  $\epsilon$  Persei. *Astrophys. J.* 2 (1895) 350.
- — —. Variable nebulae (abbrev.). *Mon. Not.* 55 (1895) 442-453.
- — —. Great photographic nebula in Scorpio. *Mon. Not.* 55 (1895) 453-456.
- — —. Extended nebulosity about  $\gamma$  Monocerotis. *Mon. Not.* 55 (1895) 63.
- — —. Invisibility of Hind's Variable Nebula. *Mon. Not.* 56 (1895) 66.
- — —. Micrometrical observations of Uranus. *Astron. J.* 16 (1896) 73-78.
- — —. Micrometrical measures of the annular nebula of Lyra. *Astron. Nachr.* 140 (1896) 283-285.
- — —. Micrometrical observations of Saturn. *Mon. Not.* 56 (1896) 163.
- — —. Physical observations of Venus. *Astrophys. J.* 5 (1897) 299-304.
- — —. Observations of the Leonid Meteors of 1898. *Astroph. J.* (1899) 151.
- Barone, G. Les Bielides. *Bull. Soc. Belg. d'Astron.* 2 (1897) 207-209.
- Bartoli, A. Potenza chimica delle radiazioni solari. *Bol. Accad. Catania* 15 (1890) 5 pp.; *Beibl.* (1891) 418.
- — — ed. Stracciati, E. Formola relativa all' assorbimento della radiazioni solari attraverso l' atmosfera. *Atti Accad. Catania* 4 (1892) 14 pp.; *Nuov. Cim.* 31 (1892) 193-208; *Beibl.* (1893) 447.
- — —. Sull' assorbimento delle radiazioni solari dalla nebbia e dai cirri. *Nuov. Cim.* 36 (1894) 287-297.
- — —. Sulla transmissibilita delle radiazioni solari attraverso l' atmosfera carica di cenere vulcanica nell' eruzione dell' Etna del 1892. *Atti Accad. Catania* (4) 7 (1894) 6 pp.; *Riv. Sci. ind.* (1894) 141-147.
- Barus, C. Trial of the Interferential Induction Balance. *Amer. J. Sci.* (4) 3 (1897) 107-117.

- Bary, P.* Indices de refraction des solutions salines. C.-R. 114 (1892) 827-831; Beibl. (1892) 735.
- . Sur la composition des solutions aqueuses de sels, d'après les indices de réfraction. C.-R. 118 (1894) 71-74.
- Basset, A. B.* Disturbance caused by one element of a sound- or light-wave. Proc. Lond. Math. Soc. 22 (1891) 317-329; Beibl. (1892) 72.
- . Reflexion und Brechung des Lichtes an der Oberfläche eines magnetisirten Mediums. Phys. Rev. (1892) 481-512.
- Basso, G.* Sulla legge di ripartizione dell'intensità luminosa fra i raggi birifratti da lumina cristallina. Nuov. Cim. 5 (1886) 210-226.
- . Carattere di reciprocità proprio della luce riflessa dai mezzi cristallini. Atti Accad. Torino 28 (1892-3) 89-94; 35 (1894) 17-22.
- Battelli, A., e Garbasso, A.* Sulla dispersione delle cariche elettrostatiche prodotta dai raggi ultravioletti. Nuov. Cim. (4) 3 (1896) 321-324.
- e *M. Pandolfi.* Sulle illuminazione dei liquidi. Nuov. Cim. 9 (1899) 321-327; Beibl. (1899) 633.
- Battermann, H.* Gestalt der Bilder und die Theorie der Messungen ausserhalb der optischen Axe von astronomischen Instrumenten. Astron. Nachr. 120 (1889) 337-416.
- Baume-Pluvinel, A. de la.* La photographie de la couronne solaire. Bull. Soc. astron. de France (1896) 228-234.
- . Groupe des raies B. du spectre solaire. C.-R. 128 (1899) 269-272.
- Baumhauer, H.* Abhängigkeit der Aetzfiguren des Apatits von der Natur und Concentration des Aetzmittels. Sitzb. Berliner Akad. (1887) 863-878.
- . Aetzerscheinungen des Strychninsulfates. Z. f. Kryst. u. Min. 17 (1889) 608-609.
- Bauschinger, J.* Neue Bestimmung der Refraktionskonstante auf astronomischem Wege. Sitzb. Muenchener Akad. (1895) 239-260; Beibl. (1896) 685.
- Bay* Sur un nouveau foyer d'incandescence. C.-R. 113 (1891) 298-300.
- Bayrac et Camichel.* Sur l'absorption de la lumière par les dissolutions d'indophenols. C.-R. 122 (1896) 193-195; Beibl. (1897) 740.
- Bazala, J.* Neue Beleuchtungs-Constructionen für Flächen. Grunert's Archiv (2) 11 (1892) 113-131; Beibl. (1893) 120.

- Bozia, J. C.* and *Smolan, S. Jr.* Conductance produced in gases by Röntgen rays, by ultra-violet light, and uranium. *Phil. Mag.* (3) 45 (1897) 418-439; *Beibl.* (1898) 184.
- Bezulari, F.* Sur la double réfraction elliptique du quartz. *C.-R.* 110 (1890) 1063-1066; 111 (1890) 173-176; *Jahresb.* (1890) 395.
- —. Sur la réfraction des rayons Röntgen. *C.-R.* 122 (1896) 752-753.
- —. Sur la non-réfraction des rayons X par le potassium. *C.-R.* 123 (1896) 301.
- Becker, L.* The solar spectrum at medium and low elevations of the Sun. *Edinb. Trans.* 36 (1891) 99-210, 10 plates; *Beibl.* (1891) 352.
- Beckmann.* Ueber die Erzeugung leuchtender Flammen zu spektroskopischen Zwecken mit Hilfe der Elektrolyse. *Beibl.* (1899) 775.
- Becquerel, E.* Sur les spectres d'absorption de l'épidote. *C.-R.* 108 (1889) 282-284; *Beibl.* (1889) 680. See *W. Ramsay, Beibl.* (1888) 53.
- Becquerel, H.* Observations relatives à une Note de M. Langley sur des longueurs d'onde jusqu'ici non reconnues. *C.-R.* 102 (1886) 209; *Jahresb.* (1868) 303.—See *ibid.* 162-164.
- —. Recherches sur les variations des spectres d'absorption dans les cristaux. *Ann. chim. phys.* (6) 14 (1888) 170-257, 257-279, planche; *Beibl.* (1889) 217.
- —. Sur les lois de l'absorption de la lumière dans les cristaux. *C.-R.* 108 (1889) 891-894.
- —. Sur les différentes manifestations de la phosphorescence des minéraux sous l'influence de la lumière ou de la chaleur. *C.-R.* 112 (1891) 557-563; *Beibl.* (1891) 419.
- —. Sur les lois de l'intensité de la lumière émise par les corps phosphorescents. *C.-R.* 113 (1891) 618-623, 672; *Beibl.* (1892) 432.
- —. Radiations émises par phosphorescence. *C.-R.* 122 (1896) 420.
- —. Sur diverses propriétés des rayons uraniques. *C.-R.* 122 (1896) 501, 559, 689, 762, 1086; 123 (1896) 855; *Astrophys. J.* 5 (1897) 66-67.
- —. Recherches sur les rayons uraniques. *C.-R.* 124 (1897) 438-444.
- —. Quelques expériences de M. G. Le Bon. *C.-R.* 124 (1897) 984-988.—See *Perrigot, ibid.* 857-859.

- Becquerel, H.* Interprétation applicable au phénomène de Faraday et au phénomène de Leeman. C.-R. 125 (1897) 679-685; Beibl. (1898) 353.
- et *H. Deslandres.* Phénomène de Zeeman. C. R. 126 (1897) 997-1001; 127 (1898) 18-24. Beibl. (1898) 891. (1899) 54.
- — Dispersion anormale de la vapeur de sodium incandescente. C. R. 127 (1898) 899-904; 128 (1899) 146-151; Beibl. (1899) 352. 509.
- — Quelques propriétés du rayonnement de l'uranium et des corps radio actifs. C.-R. 128 (1899) 771-777.
- Beddard, F. E.* Note upon phosphorescent earthworms. Nature 60 (1899) 52.
- Begouen.* La matière radiante et les comètes. Rev. sci. 30 (1847) 297.
- Bell, L.* Notes on the absorption spectrum of nitrogen peroxid. Amer. Chem. J. 7 (1885) 32-34.
- — Spectroscopic determination of lithium. Amer. Chem. J. 7 (1885) 35; Jahresh. (1885) 317, 318.—See Vierordt, Jahresh. (1870) 171; (1871) 189; (1878) 176.
- — Ultra-violet spectrum of cadmium. Amer. J. Sci. (3) 31 (1886) 426-431, Jahresh. (1886) 303.
- — The absolute wave-length of light. Phil. Mag. (5) 25 (1888) 245-263, 350-372; Amer. J. Sci. (3) 33 (1887) 161-182; 35 (1888) 265-282; Beibl. (1887) 820, 853-854.
- Belopolsky, A.* Ueber die Corona-Photographien Aug. 18-19, 1887. Astron. Nachr. 124 (1890) 183-186. Beibl. (1891) 207.
- — Bewegungen die Man an der Sonnenoberfläche beobachtet. Astron. Nachr. 125 (1890) 17-22, 251-254; Beibl. (1890) 621; (1891) 107-206.
- — Projekt zur Reproduktion der Verschiebung von Spektrallinien bewegter Lichtquellen. Astron. Nachr. 137 (1894) 33-36; Astron. and Astrophys. (1894) 130-136.
- — Spectre du variable  $\delta$  Cephei. Bull. Acad. St. Petersb. (1894) 267-306; Astron. Nachr. 136 (1894) 281-284; 140 (1896) 17-21; Astrophys. J. 1 (1895) 160, 263-265.
- — Angeblliche Umkehrung der Heliumlinie. Mem. Spettr. Ital. 23 (1894) 89; Beibl. (1895) 422.
- — Spectrographic performance of the 30 inch Pulkowa refractor. Astrophys. J. 1 (1895) 366-371; 3 (1896) 147-149; Beibl. (1896) 25.
- — Verschiebung von Linien im Spektrum des Saturns und seines Ringes. Bull. Acad. St. Petersb. 3 (1895) 379-403; Beibl. (1896) 370.

- Belopolsky, A. Com' J.* Spektrographische Untersuchungen des Saturnrings. *Astron. Nachr.* 139 (1896) 1-4. *Astrophys. J.* 3 (1896) 79.
- —. Spektrographische Untersuchungen über Jupiter. *Astron. Nachr.* 139 (1896) 200-214; Beibl. 11807-312.
- —. Eigenbewegung der helleren Componente von 61 Cygni. *Astron. Nachr.* 140 (1896) 21.
- —. Veränderung in dem Sternhaufen N G C 5272. *Astron. Nachr.* 140 (1896) 23.
- —. Observations des raies renversees dans le spectre des protubérances faites à Poulkovo. *Mem. Spett. Ital.* 25 (1896) 23-26.
- —. Spectroscopic binary  $\alpha'$  Gemminorum. *Astrophys. J.* 5 (1897) 1-7.
- —. New investigations of the spectrum of  $\beta$  Lyrae. *Astrophys. J.* 6 (1897) 325-337.
- —. Researches on the spectrum of the variable  $\eta$  Aquilae. *Astrophys. J.* 6 (1897) 393-399.
- —. Vitesses radiales des composantes de  $\gamma$  Virginis. *Bull. Acad. St. Petersb.* 8 (1898) 141-158.
- —. Mouvement rapide de la ligne des absides. *Mem. Spett. Ital.* (1899) 103-108.
- Beltrami, E.* Espressione analytica del principio di Huygens. *Rend. Accad. Roma* (5) 1 (1892) 99-108; Beibl. (1890) 496.
- —. Teorema di Kirchhoff. *Rend. Accad. Roma* 4 (1895) 51-52.
- Bender, C.* Brechungsexponenten von Salzlösungen. *Ann. Phys. u. F.* 39 (1890) 82.
- —. Brechungsexponenten reinen Wassers und Salzlösungen. *Ann. Phys.* 68 (1899) 343-349.
- Bem. thensi.* Combustione nell'aria rarefatta. *Atti Accad. Lincei* 5 (1896) 404-410.
- Benoist, L., et Hurmuzescu, D.* Nouvelles propriétés des rayons X. *C.-R.* 122 (1896) 235-236.
- Benoit, R.* Application des phénomènes d'interférence à des déterminations météorologiques. *Soc. franç. de phys.* (1897) 95-106; *J. de phys.* 7 (1898) 57-69.
- Berberich, A.* Helligkeit des Encke'schen Cometen. *Astron. Nachr.* (1888) 49-66.
- —. Neue Untersuchungen über Nebelspektren. *Beibl.* 336.
- —. Die Atmosphäre des interplanetischen Raumes und die Kometen-Naturwiss. *Rundschau* 14 (1899) 365-380; *Beibl.* (1899) 785-787.
- —. Die veränderlichen Sterne. *Naturwiss. Rund.* (1899) 465, 481.



- Berget, A.* Méthode optique pour déterminer la conductibilité thermique des barres métalliques. C.-R. 114 (1892) 1350-1352.
- Berghoff, V.* Bestimmung der Brechungsexponenten von Schwefel und Phosphorlösungen. Diss. Marburg, 1893; Beibl. (1895) 327.
- Bergstrand.* Influence de la réfraction et de l'aberration sur les mesures photogrammétriques des étoiles. Stockholm Akad. Forh. (1897) 51-67.
- Bernstein, J.* Beugungsspektrum des quergestreiften Muskels bei der Kontraktion. Naturwiss. Rundsch. 10 (1895) 540.
- Berthelot, Daniel.* Mesure des hautes températures par la méthode interférentielle. C.-R. 126 (1898) 410-412.
- . Remarques à propos de MM. Ramsay et Travers (sur Krypton et Metargon). C.-R. 126 (1898) 1613; Beibl. (1898) 513.
- . Sur quelques relations entre les énergies lumineuses et les énergies chimiques, et sur les déplacements entre l'oxygène et les éléments halogènes. Ann. chim. phys. (7) 16 (1899) 320-324; C.-R. 127 (1898) 143-160.
- Berthelot, Marcellin.* Nouvelles recherches de M. Ramsay sur l'argon et sur l'hélium. Compt. rend. 120 (1895) 660.—See Ramsay, Nature (1895) 51.
- . Spectres de l'argon et de l'aurore boréale. C.-R. 120 (1895) 662-664.
- . Essais pour faire entrer l'argon en combinaison chimique. C.-R. 120 (1895) 581-585.
- . Observations sur l'argon; spectre de fluorescence. C.-R. 120 (1895) 797-801.
- . Nouvelle combinaison de l'argon. C.-R. 120 (1895) 1316-1320.
- . Nouvelles études sur la fluorescence de l'argon et sur sa combinaison avec les éléments de la benzine. C.-R. 120 (1895) 1386-1390.
- . Recherches sur l'argon et sur ses combinaisons. Ann. chim. phys. (7) 7 (1896) 5-26.
- . Absorption de la lumière par les cristaux. Ann. chim. phys. 7 (1896) 53-94.
- . Recherches sur l'hélium. C.-R. 124 (1897) 113-119.
- . Nouvel appareil pour l'application de l'analyse spectrale à la reconnaissance des gaz. C.-R. 124 (1897) 525-528; Ann. chim. phys. (7) 11 (1897) 43-77.
- Bertin, H.* Sur le spectre de la méthémoglobine acide. C.-R. 106 (1888) 1243-1245.

- Beck*, J. W. On the delicacy of spectroscopic reaction in gases. Manchester Lit. Phil. Soc. (1887) 109-211. Beibl. (1888) 102
- Brass*, A. Studien über die Erlen der Cerium und Yttrium-Gruppe. Liebig's Ann. 259 (1890) 159-170, 203 (1891) 164-174, 270 (1892) 370-383
- Bruntz*, H. Historische Uebersicht über die Untersuchungen der Verteilung der Wärme im Sonnenspektrum. Programm. Neuwied, 1896. 40 pp. Beibl. (1898) 355
- Brown*, W. A. Wissenschaftliche Luftballonfahrten. Beibl. (1897) 470
- Brown*, E. Sulla distemperanza dell' ebollente. Nuov. Cim. (4) 8 (1895) 257-260. Beibl. (1896) 637
- Brown*, E. Sur le calcul des franges de Talbot. Arch. de Geneve 25 (1891) 5-8.
- Brown*, S. Lightning and the electric spark. Nature 41 (1890) 151-154, 213
- Solutions of Alum. Nature 44 (1891) 565. Beibl. (1891) 210
- Bull*, J. Ueber die Verwendung des Refraktometers. Beibl. (1891) 278
- Burton*, F. H. Further study of the solar corona. Amer. J. Sci. (3) 40 (1890) 343-358. Beibl. (1891) 107
- Actinic light of the solar corona. Nature 41 (1890) 138. Beibl. 1890 787.
- Reply to Prof. Nipher. Amer. J. Sci. (3) 41 (1891) 505-507. Beibl. (1891) 644
- The Solar Corona. Amer. J. Sci. (3) 42 (1891) 1-11. Beibl. (1891) 717.
- The Polar Radiation from the Sun. Astron. and Astrophys. 13 (1893) 26-40
- Burgelman*, G. Le nouveau étoile de 1892, T. Aurigæ. C.-R. 117 (1893) 655-657
- Nebuleuses nouvelles, decouvertes à Paris. C.-R. 123 (1896) 1243-1245, 124 (1897) 65-67, 133-135.
- Birkeland*, M. Spectre des rayons cathodiques. C. R. 126 (1898) 228-231, 492-495
- Blak*, J. Spectre des substances inorganiques et leur action biologique. C.-R. 104 (1887) 1544-1546, Jahresh. (1887) 2344
- Des rapports entre les spectres des elements et leurs actions biologiques. Mem. Soc. de Biologie (1890) 4 pp. Z. physikal. Chem. 5 (1890) 217-220.



- anchard, C. T.* New element in the sulphur group. *Nature* 50 (1894) 571.
- asius, Eug.* Interferenzerscheinungen in zwei planparallelen Platten. *Ann. Phys. n. F.* 45 (1892) 316, 385.
- kekrode, J. L., and J. W. Gifford.* Radiographs by fluorescent screens. *Nature* 53 (1895) 557.
- litz, H., und V. Meyer.* Ueber die Dampfdichtebestimmung einiger Elemente und Verbindungen bei Weissgluth. *Ber. chem. Ges.* 22 (1889) 725-727.
- —. Vorlesungsversuche, die Diffusion der Gase betreffend. *Z. phys. Chem.* (1892) 152.
- loch, R. S.* Reflexion und Brechung durch Körper mit anomaler Dispersion. *C.-R.* 111 (1890) 822-824; *Beibl.* (1891) 213.
- — —. Ueber die anomale Dispersion. *C.-R.* 116 (1893) 746-748.
- — —. Mesure du pouvoir absorbant pour la lumière de lames minces possédant la réflexion métallique. *C.-R.* 117 (1893) 661-663.
- — —. Absorption métallique de la lumière et des phénomènes optiques qui s'y rattachent. *Ann. chim. phys.* (7) 11 (1897) 74-115.
- — —. Absorption métallique de la lumière. *J. de phys.* 7 (1898) 69-81.
- Blondel, A.* Les unités photométriques. *J. de phys.* 6 (1897) 187.
- — et *J. Rey.* Eclat des projecteurs de lumière. *C.-R.* 126 (1898) 404.
- Blondlot, R.* Double réfraction diélectrique. *C.-R.* 106 (1888) 349-354.
- Blyth, A. W.* The ultraviolet absorption spectra of albumenoids. *Chem. News* 80 (1899) 32; *J. Chem. Soc.* June 15, 1899.
- Blythwood, Lord.* Reflection of Röntgen Light from polished speculum-metal mirrors. *Proc. Roy. Soc.* 49 (1896) 330-332.
- Boek, A.* Der blaue Dampfsrtrahl. *Ann. Phys. n. F.* 68 (1899) 674-687.
- odi, P.* Das Newton'sche Experimentum Crucis. *Beibl.* (1892) 734.
- oeddicker, O.* Observations of the Planet Jupiter. *Dublin Trans.* 4 (1888) 272-288; *Beibl.* (1889) 687.
- —. Lunar Radiant Heat. *Dublin Trans.* (2) 4 (1892) 481-512.
- hlendorff, W.* Studien zur Absorptions-Spektralanalyse. *Diss.* Erlangen, 1890, 80 pp.; *Beibl.* (1891) 716.

- — — Fluorescence des composés de magnésie soumis à l'effluve électrique dans le vide. C.-R. 103 (1886) 133; Chem. News 22 (1886) 43; Jahresb. (1886) 308.  
 — — — Fluorescence des composés de magnésie soumis à l'effluve électrique dans le vide. C.-R. 103 (1886) 133; Jahresb. (1886) 308.  
 — — — Sur la fluorescence de l'oxyde de strontium. C.-R. 102 (1886) 647.  
 — — — Purification de l'yttria. C.-R. 103 (1886) 627.  
 — — — Fluorescences de magnésie et de l'yttria. C.-R. 103 (1886) 163-171, 1061; 104 (1887) 1580; 105 (1887) 45-48, 206, 751, 1223.  
 — — — Sur la fluorescence anciennement attribuée à l'yttria. C.-R. 103 (1886) 1336; Jahresb. (1886) 308-310.  
 — — — Fluorescence rouge de la galène chromifère. C.-R. 104 (1887) 1541-1543; Beibl. (1887) 786.  
 — — — Fluorescences à raies en raillant fortement de l'alumine contenant un peu de diopside ou de praséodyme. C.-R. 105 (1887) 253-261, 301-304; Beibl. (1887) 780.  
 — — — Nouvelles fluorescences à raies spectrales bien définies. C.-R. 105 (1887) 734-738; Beibl. (1887) 783.  
 — — — A quel degré d'oxydation se trouve le chrome et le manganèse dans leurs composés fluorescents? C.-R. 104 (1887) 1288-1333; 105 (1887) 452-455; 106 (1888) 451-455, 468-471, 490-494, 1731-1734.  
 — — — Fluorescence de la chaux cuprifère. C.-R. 106 (1888) 1336-1337.  
 — — — Sur quelques nouvelles fluorescences. C.-R. 110 (1890) 24-28, 67-71.  
 — — — Nouvelles recherches sur la gadoline de M. de Marignac. C.-R. 111 (1890) 393-395.  
 — — — Sur l'équivalent de la gadoline. C.-R. 111 (1890) 409-411.  
 — — — Spectre électrique du chlorure de gadolinium. C.-R. 111 (1890) 472-474; Beibl. (1891) 106.  
 — — — Recherches sur le samarium. C.-R. 114 (1892) 575-577.  
 — — — Spectre électrique du Gallium. C.-R. 114 (1892) 815-818; Beibl. (1892) 532.  
 — — — Recherches sur le samarium. C.-R. 117 (1893) 199-201.

- Boisbaudran, F. Lecoq de.* Classification des éléments chimiques. C.-R. 120 (1895) 1097-1104; 124 (1897) 127-130.
- —. Un élément probablement nouveau existant dans les terribines. C.-R. 121 (1895) 709; Beibl. (1896) 276.
- —. Examen de quelques spectres (cuivre, argent, potassium, or). C.-R. 124 (1897) 1288-1290, 1419-1421; Beibl. (1897) 735; Chem. News, 76 (1897) 12, 46.
- Bonacini, C.* La cromofotografia interferenziale. Mem. Spettro. Ital. 23 (1894) 146-154; Beibl. (1895) 71.
- Booth, W.* Fresnel's Wave Surface. Dublin Trans. (2) 6 (1897) 205-212.
- Borel, G. A.* Réfraction et dispersion des radiations ultra-violettes dans quelques substances cristallisées. Arch. de Geneve 34 (1895) 134-157, 230-249; C.-R. 120 (1895) 1404-1406; Beibl. (1896) 42.
- Borgesius, A. H.* Molekularrefraction und Dispersion einiger Salze in Lösungen. Ann. Phys. n. F. 54 (1895) 221-243.
- Borgmann, J. J.* La thermoluminescence provoquée par les rayons de M. Röntgen et les rayons de M. Becquerel. C.-R. 124 (1897) 895-896.
- Born, Max.* Bestimmung der Lichtbrechungsverhältnisse doppelt brechender Krystalle. Neues Jahrb. Min. Geol. Pal. (1887) 5. Beilage Bd., 1-51.
- Bose, J. C.* Indices of refraction of various substances for the electric rays. Proc. Roy. Soc. 59 (1896) 160-167; 62 (1898) 293-300.
- —. Wave-length of electric radiation by diffraction grating. Proc. Roy. Soc. 60 (1896) 167-178.
- Bostwick, A. E.* Absorption spectra of mixed liquids. Amer. J. Sci. (3) 37 (1889) 471-473; Beibl. (1889) 814.
- Bothamley, C. H.* Orthochromatic Photography. Jour. Chem. Indust. Manchester, Eng. 6 (1887) 423; Jahresb. (1887) 2723.
- Bottomley, J. T.* Thermal Radiation in Absolute Measure. Proc. Roy. Soc. 42 (1887) 357-359, 433-437; Phil. Trans. 187 (1887) 429-450; Beibl. (1887) 701; (1888) 344-346.
- —. Thermal Radiation in Absolute Measure. Proc. Roy. Soc. 52 (1892) 162-163; Phil. Trans. 184 (1893) 591-646; Beibl. (1893) 121, (1894) 336.
- —. On Röntgen's Rays. Nature 53 (1896) 268-269.
- Bouasse, H.* Différence de phase d'une réfraction lumineuse. C.-R. 111 (1890) 100-102.
- —. Réflexion et réfraction dans les milieux isotropes, transparentes et absorbants. Ann. chim. phys. (6) 28 (1893) 145-237, 433-498.

- BoucharJ, C.* Sur la présence de l'argon et de l'hélium dan certains eaux minerales. C.-R. 121 (1895) 392-394.
- Boudouard, J.* Sur le neodyme C.-R. 126 (1898) 900-901.
- On the Yttric Earths contained in the Monazite Sands. Chem. News, 76 (1898) 28.
- Boulouch, R.* Sur la photometre de Bunsen C.-R. 111 (1890) 642-644. Beibl. (1891) 105.
- Dédoublément des fringes d'interference en lumiere naturelle. J. de phys (3) 2 (1893) 316-320. Beibl. (1894) 194.
- Secundare Streifen in den Newton'schen Ringen J. de phys. (3) 3 (1894) 24-31. Beibl. (1894) 571.
- Baumann, Z. P.* Emission und Absorption von Quarz und Glas. Zitt Akad. Amsterdam 5 (1896-1897) 438-442; Beibl. (1897) 589.
- Boussinesq, J.* Considérations diverses sur la théorie des ondes lumineuses. C.-R. 117 (1893) 193-199.
- Bouty, E.* Double refraction des rayons de force électrique. Soc. franç. de phys. 3 (1895) 218-222.
- Flammes sensibles. C.-R. 120 (1895) 1260-1262, 122 (1896) 372-374. J. de phys 4 (1895) 401-411; 5 (1896) 402-404.
- Braun, D. B.* Note on steady liquid surfaces. Astrophys J. 5 (1897) 214.
- Achromatic Polarization and differential double refraction. Phil Mag. (5) 48 (1899) 345-360.
- New spectrophotometer and a method of optically calibrating the slit. Proc Amer Assoc. (1899) 115.
- Brandes, G.* Sichtbarkeit der Rontgen Strahlen Sitzb. Berliner Akad (1896) 547-550.
- Brandsepi, A.* Certains phénomènes observés avec la combustion rationelle du gaz. Soc franç de phys. (1893) 284-290.
- Branly, E.* Largeur des fringes dans l'expérience des deux miroirs. J. de phys. 7 (1888) 69-72.
- et *G. Le Bon.* Sur l'absorption des ondes herziennes par les corps non-métalliques. C.-R. 128 (1899) 879-882.
- Braun, C.* Prisma a vision directe. Ber aus Ungarn. 3 (1886) 197-200. Beibl. (1888) 335.
- Braun, F.* Versuch über Lichtemission glühender Körper. Gott. Nachr. (1887) 465-467.
- Brauns, K.* Beobachtungen an Chlor-Brom-Zimmtaldehyd. Neues Jahrb. f. Min. Geol. u. Paleont 2 (1891) 12-20.
- Brédikhine, Th.* Mouvement des substances émises par les comètes 1893 II et 1893 IV. Bull Acad St Petersburg 5 II (1895) 383-397.

- Bremer, H.* Einfluss der Temperatur gefärbter Lösungen auf die Absorptionsspectren derselben. Diss. Erlangen 1890; Beibl. (1891) 768.
- Brennand, W.* Photometric observations of the Sun and Sky. Proc. Roy. Soc. 49 (1891) 4-11, 255-280; Beibl. (1891) 355, 517.
- Brenner, L.* Deux taches remarquables sur Jupiter. Bull. Soc. astron. France 2 (1896) 30-31.
- . Die Schatten auf der Venus. Astron. Nachr. 139 (1896) 25-27, 313-318; 140 (1896) 175; Beibl. (1897) 341; Observ. (1896) 206-207.
- . Sichtbarkeit der Nachtseite des Mercur. Astron. Nachr. 140 (1896) 347.
- . Rotation of Venus. Naked-eye views of Mercury. Spots on Saturn. Observ. 19 (1896) 161.
- . Uranus-Beobachtungen. Astron. Nachr. 142 (1897) 37-42.
- . Veränderungen auf dem Mars. Astron. Nachr. 143 (1897) 41-43.
- . Observations de Saturne. Bull. Soc. astron. France (1897) 326-327.
- Brester, Jr., A.* Theorie der Sonne. Beibl. (1893) 447.
- . On Brester's views as to the tranquillity of the Solar atmosphere. Astr. and Astroph. 13 (1894) 849-856. See Astrophys. J. 1 (1895) 260-262.
- . Variability of Red Stars. Nature 53 (1896) 248-249.
- Breuer, A.* Mathematische Theorien über die Dispersion des Lichts. I, Hannover 1889, J. Bachmeister, 55 pp.; II, Erfurt: Bachmeister, 1891; Beibl. (1892) 273.
- Briard, R.* Sur un déplacement remarquable. C.-R. 123 (1896) 939-940.
- Brillouin, M.* Sur la propagation des vibrations dans les milieux absorbants isotropes. C.-R. 115 (1892) 808-811.
- . Les taches solaires et le temps. C.-R. 123 (1896) 484-486.
- Broad, A.* Sur l'achromatisme. C.-R. 114 (1892) 216-220.
- . Sensations visuelles et la photométrie. J. de phys. 3 (1893) 206-213; Soc. franç. de phys. (1894) 81-93.
- . Aenderungen der Schwingungszeiten bei Spektrallinien; Rev. des Sci. 8 (1897) 935-939; Beibl. (1898) 350.
- . Quelques propriétés des décharges électriques, produites dans un champ magnétique. Assimilation au phénomène de Zeeman. Soc. franç. de phys. (1898) 23-31.

- Brohm, E.* Empfindlichkeit des grünblinden und des normalen Auges gegen Farbenänderung im Spectrum. Z. d. Sinnesorgane (1892) 97-117. Beibl. (1892) 274.
- Brockmann, K.* Elemente der Cerium- und Yttriumgruppe. Diss. Erlangen 1891. Beibl. (1891) 515.
- Brooks, E. E.* Phosphorescence of lithium compounds in a vacuum, and the spectra of covered electrodes. Chem. News, 62 (1890) 239, 64 (1891) 30. Beibl. (1891) 109; (1892) 426.
- Brown, Miss E.* Third Report of the section for the observation of the Sun. Mem. Brit. Astron. Assoc. 3 III (1895) 49-120.
- and *Noble, W.* Variable orange stars. Observatory 18 (1895) 200-202.
- Bruce, Miss Catherine W.* Miss Bruce's gift to the Astrophysical Journal to be used for providing illustrations for the Astrophysical Journal. Astrophys. J. 3 (1896) 150.
- Bruce Spectroscope (The)*. Described by H. H. Newall of Harvard Observatory. Astrophys. J. (1896) 266-281.
- Brière, Miss Alice H.* A comparison of two concave Rowland gratings. Phys. Rev. 3 (1896) 301-305; Beibl. (1896) 653.
- Briunl, J. W.* Molekularrefraktion organischer flüssiger Körper von grossem Farbenzerstreuungsvermögen. Ber. chem. Ges. 19 (1886) 2746.
- — — Die Brechungsindices des Wassers. Ber. chem. Ges. (1891) 644-649.)
- — — Beziehungen zwischen den spektrometrischen Constanten und der chemischen Constitution des Epichlorhydrins, des Acet und Paraldehyds und des Benzols. Ber. chem. Ges. 24 (1891) 656-658; Beibl. (1891) 555.
- — — Dispersion und chemische Zusammensetzung der Körper, nebst einer Neuberechnung der Atomrefractionen. Ztsch. physikal. Chem. 7 (1891) 140-193.
- — — Zur Kenntniss des Acetessigaethers. Ber. chem. Ges. 25 (1892) 366-370.
- — — Ueber das Trimethylen. Ber. chem. Ges. 25 (1892) 1952-1956.
- — — Die Spektrochemie des Stickstoffs. Ber. chem. Ges. 26 (1893) 806-810.
- — — Die Spektrochemie des Stickstoffs, I., II., III., IV. Abhandlungen. Ztsch. physikal. Chem. 22 (1895) 193-241, 497-524, 24 (1897) 373-409, 25 (1898) 577-650; 26 (1898) 47-76; Beibl. (1895) 564, (1897) 586-588; (1898) 480, 661.



- Bruchl, J. W.* Spektrochemische Untersuchung des  $\alpha$  und  $\beta$  Mesityloxydoxalsäurem-Methyls und Aethyls von Claisen. *Liebig's Ann.* 291 (1896) 137-146; *Beibl.* (1896) 871.
- — —. Stereochemisch-spektrische Versuche, I. *Ztsch. phys. Chem.* 21 (1896) 385-413; *Beibl.* (1897) 224-226.
- — —. Spektrometrische Bestimmungen. *Ber. chem. Ges.* 30 (1897) 158-162.
- — —. Hydrazin, Wasserstoffsperoxyd, Wasser. *Ber. chem. Ges.* (1897) 162-172.
- — —. Spektrochemie des Stickstoffs, VI., Die Sauerstoffverbindungen. *Ztsch. physikal. Chem.* 25 (1898) 577-650; 26 (1898) 47-76.
- Brun, A.* Note sur le spectre d'absorption des grenats almadins. *Beibl.* (1893) 335; *Arch. de Genève*, 28 (1892) 410-413.
- Brunhes, B.* Expérience sur les spectres canelées. *J. de phys.* (2) 10 (1891) 508-512; *Beibl.* (1892) 435.
- — —. Théorie électromagnétique de l'absorption de la lumière dans les cristaux. *C.-R.* 120 (1895) 1041-1044.
- — —. Condition de biréfringence d'un milieu et sur l'absorption cristalline. *J. de phys.* 5 (1896) 12-22; *Beibl.* (1896) 374.
- Brush, C. F.* A new gas. *J. Amer. Chem. Soc.* 20 (1898) 899-912.
- See Dorn, *Beibl.* (1899) 203.
- Bruttini, A.* Determinazione colorimetrica di piccole quantita di uranio nei minerali. *Gazz. chim. Ital.* (1893) 251-257; *Beibl.* (1893) 927.
- Buckingham, E.* Einige Fluoreszenzerscheinungen. *Z. phys. Chem.* 14 (1894) 129-148; *Beibl.* (1895) 69.
- Budde, E.* Eine neuere Entdeckung des Hrn. Janssen welche sich auf das Sauerstoffspektrum bezieht. *Beibl.* (1889) 501-502.
- Bugnet, A.* L'absorption des rayons X. *C.-R.* 125 (1897) 375-377.
- Buisson, H.* Mesure de la vitesse des particules électrisées dans la décharge par la lumière ultraviolette. *C.-R.* 127 (1898) 224-227; *Beibl.* (1898) 803.
- Bunte, H.* Einfluss der Luftveränderung auf die Leuchtkraft der Flammen. *Beibl.* (1891) 713; (1892) 209.
- — —. Ueber die neuere Entwicklung der Flammenbeleuchtung. *Ber. chem. Ges.* 31 (1898) 5-25.
- Burbank, J. E.* Photography of the least refrangible end of the solar spectrum. *Phil. Mag.* (5) 26 (1888) 391-393; *Jahresb.* (1888) 434.
- — —. X-rays and mineral phosphorescence. *Amer. J. Sci.* (4) 5 (1898) 53-55.

- Burch, G. J.* Experiments with flame. *Nature* 35 (1887) 165.  
 — — —. The tangent lens-gauge. *Phil. Mag.* (5) 43 (1897) 256–259.  
*Burke, J.* Some experiments on absorption and fluorescence. *Rept. Brit. Assoc.* (1896) 731.  
 — — —. On the change of absorption produced by fluorescence. *Proc. Roy. Soc.* 61 (1897) 485–487; *Phil. Trans.* 191 (1898) 87–104.  
*Burmeister, L.* Homocentrische Brechung des Lichtes durch das Prisma. *Ztsch f. Math. u. Phys.* 40 (1895) 65–90, 321–326; *Beibl.* (1895) 627.  
*Burnham, S. W.* Proper motions of double stars. *Astron. and Astroph.* (1893) 14.  
*Bury, O.* Bemerkung über das Kirchhoff'sche Gesetz. *Ann. Phys. n. F.* 52 (1894) 205.  
*Buss, O.* Spectralanalyse einiger Farbstoffe mit besonderer Berücksichtigung des Ultraviolett. *Diss. Bern*, 1896; *Beibl.* (1897) 130.

## C

- Cajori, F.* Search for solar X-rays on Pike's Peak. *Amer. J. Sci.* 2 (1896) 289.  
*Callandreaux, O.* Désagrégation des comètes. *C.-R.* 123 (1896) 663.  
*Camerer, R.* Totalreflexion des Lichts. *Ztsch. Kryst. u. Min.* 28 (1897) 623–624.  
*Camichel, Ch.* Absorption de la lumière dans le brome liquide. *C.-R.* 117 (1893) 307–309.  
 — — —. Absorption de la lumière dans les cristaux. *Soc. franç. de phys.* (1895) 50–56; *Ann. chim. phys.* (7) 5 (1895) 433–493; *Beibl.* (1896) 129.  
*Campanile, F.* Su alcune costanti dell' ebonite. *Nuov. Cim.* 1 (1895) 259–261.  
 — — — ed *E. Stromei.* La fosforescenza ed i raggi X nei tubi di Crookes e di Geissler. *Nuov. Cim.* (4) 3 (1896) 229–230.  
 — — —. Su alcuni fenomeni di fosforescenza. *Nuov. Cim.* (4) 6 (1897) 417–421; *Beibl.* (1898) 702.  
*Campbell, W. W.* Das Spectrum des Kometen 1893 (Rordame-Quénisset). *Astron. Nachr.* 133 (1893) 149–152; *Beibl.* (1894) 766.  
 — — —. The nature of Nova Aurigæ's spectrum. *Astron. and Astrophys.* 12 (1893) 722–730.



- Campbell, W. W.* Hydrogen of the envelope of the star D M + 30°  
3639. *Astron. and Astrophys.* 12 (1893) 913-914; *Beibl.* (1894)  
565.
- . Spectra of the Great Nebula in Orion and other well-  
known nebulae. *Astron. and Astrophys.* 13 (1894) 384 398,  
494 501; *Beibl.* (1895) 68.
- . The Wolf Rayet Stars. *Astr.-Astroph.* 13 (1894) 448-  
476; *Beibl.* (1895) 67.
- . Spectrum of Mars. *Astr.-Astroph.* 13 (1894) 752 760.
- . Review of the spectroscopic observations of Mars. *As-  
trophys. J.* (1895) 28 44; *Beibl.* (1896) 37.
- . Recent changes in the spectrum of Nova Aurigæ. *As-  
trophys. J.* (1895) 49 51; *Beibl.* (1895) 432.
- . On determining the extent of a planet's atmosphere.  
*Astrophys. J.* 1 (1895) 85.
- . A spectrographic determination of velocities in the system  
of Saturn. *Astrophys. J.* 2 (1895) 127-135; *Beibl.* (1896) 201.
- . The visible spectrum of the Trifid Nebula. *Astrophys.*  
*J.* 2 (1895) 161.
- . Note on the spectrum of the Aurora Borealis. *Astroph.*  
*J.* 2 (1895) 162.
- . Observations of the B band in stellar spectra. *Astrophys.*  
*J.* 2 (1895) 163.
- . Stars whose spectra contain both bright and dark hydro-  
gen lines. *Astrophys. J.* 2 (1895) 177-184; *Beibl.* (1896) 372.
- . Observations of Nova (5533 R) Normæ. *Amer. J. Sci.*  
(4) 15 (1895) 100.
- . Melting of the Polar Cap of Mars. *Pub. Astr. Soc. Pac.*  
7 (1895) 292-293.
- . Mr. Jewell's observations of the spectrum of Mars. *As-  
trophys. J.* 4 (1896) 79.
- . Mr. Lowell's book on Mars. *Pub. A. S. Pac.* 8 (1896)  
207-220.
- . Notes on two variable stars. *Astron. J.* 16 (1896) 24.
- . Spectroscopic Notes. *Astrophys. J.* 5 (1897) 233-242.
- . Variations observed in the Orion Nebula. *Astrophys. J.*  
6 (1897) 363.
- . Recent observations of the spectrum of Mars. *Pub. A. S.*  
*Pac.* (1897) 109-112.
- . Some stars with great velocities in the line of sight. *As-  
troph. J.* 8 (1898) 157.

- Campbell, W. W.* (cont'd). The variable velocity of  $\alpha$  Leonis in the line of sight. *Astroph. J.* 8 (1898) 291. That of  $\chi$  Draconis. *Astroph. J.* 8 (1898) 292.
- . Spectrum of  $\alpha$  Ceti. *Astroph. J.* 9 (1899) 31-36.
- . Variable velocity of  $\zeta$  Geminorum in the line of sight. *Astroph. J.* 9 (1899) 36. do of  $\epsilon$  Pegasi *ibid.* 310, of  $\theta$  Draconis, *ibid.* 311.
- . Visible spectrum of Nova Sagittarii. *Astroph. J.* 9 (1899) 308.
- . Comparison of the visual hydrogen spectra of the Orion Nebula and of a Geissler tube. *Astrophys. J.* 9 (1899) 312-317.
- . Influence of the Purkinje Phenomenon on observations of faint spectra. *Astrophys. J.* 8 (1898) 317-319. 10 (1899) 22-24. —See also Hering und Hillebrand Sitzb. Wiener Akad. (1889); *König Ann. Phys. n. F.* 45 (1892) 607, and Scheiner. *Astrophys. J.* 7 (1898) 295.
- . The spectroscopic binary Capella. *Astrophys. J.* 10 (1899) 177.
- . Variable velocities in the line of sight of  $\epsilon$  Libræ,  $k$  Draconis,  $\iota$  Andromedæ,  $\epsilon$  Ursæ Minoris and  $\alpha$  Draconis. *Astrophys. J.* 10 (1899) 178-179; do. of  $\alpha$  Ursæ Minoris, *Astrophys. J.* 10 (1899) 180-183; do. of  $\beta$  Capricorni and of  $\nu$  Sagittarii, *ibid.* 241.
- . The wave-length of the green coronal line, and other data resulting from an attempt to determine the law of rotation of the Solar Corona. *Astrophys. J.* 10 (1899) 186-192.
- Candolle, C. de.* Étude de l'action des rayons ultraviolette sur la formation des fleurs. *Arch. de Genève* 28 (1892) 265-277.
- Cantone, M.* Sui sistemi di frangie d'interferenza prodotte da una sorgente di luce a due colori. *Nuov. Cim.* (3) 23 (1888) 59-64; *Beibl.* (1889) 20.
- Cantoni.* Congetture su le azioni a distanza. *Rend. Accad. Roma* (1890) 379-383.
- Capps, E. V.* Optical calibration of the slit of a spectrometer. *Proc. Amer. Assoc.* 48 (1899) 131.
- Carbutt, J.* Photographing the Invisible. *Wilson's Photogr. Mag.* 34 (1897) 221-225.
- Cardani, P.* Sulle scariche elettriche nel rame e nel ferro. *Atti Accad. Roma* 4 (1895) 242-250.
- Caruazzi, P.* Influenza della pressione sull'indice di rifrazione dei gas. *Nuov. Cim.* 6 (1897) 385-401; *Beibl.* (1898) 661.

- Carrara, G.* Sul peso molecolare e sul potere rifrangente dell'acqua ossigenata. Rend. Accad. Roma (5) 1 (1892) 19-25; Beibl. (1893) 116.
- —. Influenza degli alogeni sul valore ottico dei doppi legami. Rend. Accad. Roma (5) 17 (1893) 353; Beibl. (1893) 742.
- — ed A. Minozzi. Ueber die Farbung der Ionen. Beibl. (1898) 560; Gazz. chim. Ital. 27 (1897) 455-467.
- Carvalho, E.* Einfluss des Briot'schen Dispersionsgliedes auf die Gesetze der Doppelbrechung. Beibl. (1891) 563; Ann. École norm. (3) 7 Suppl. (1890) 3-120.
- —. Position de la vibration lumineuse; système de Fresnel et de M. Sarrau. C.-R. 112 (1891) 431-433; Beibl. (1891) 563.
- —. Compatibilité des lois de la dispersion et de la double réfraction. C.-R. 112 (1891) 521-523; Beibl. (1891) 563.
- —. Pouvoir rotatoire des rayons infra-rouges du quartz. C.-R. 114 (1892) 288-291; Ann. chim. phys. (6) 26 (1892) 113-144; Beibl. (1892) 672.
- —. Absorption cristalline. C.-R. 114 (1892) 661-664; Beibl. (1892) 602.
- —. Perfectionnement à la méthode de M. Mouton pour l'étude du spectre calorifique. Soc. franç. de phys. (3) 2 (1893) 27-36; Beibl. (1893) 562.
- —. Cas de la réflexion cristalline. Soc. franç. de phys. (1893) 290-99; Beibl. (1894) 576.
- —. Spectre calorifique de fluorine. C.-R. 116 (1893) 1189-1192; 117 (1893) 306-307, 845; Beibl. (1893) 917, 1046.
- —. Principe de Huyghens dans les corps isotropes. C.-R. 120 (1895) 88-91.
- —. Spectres calorifiques. Ann. chim. phys. (7) 4 (1895) 5-79; Beibl. (1895) 566.
- —. Absorption de la lumière par les cristaux. Ann. chim. phys. (8) 7 (1896) 58-94.
- —. Recherches de précision sur la dispersion infra-rouge du quartz. C.-R. 126 (1898) 728-731, 950-953; Beibl. (1899) 31.
- Cassie, W.* On the effect of temperature on the refractive index of certain liquids. Proc. Roy. Soc. 49 (1891) 343-345.
- Cattell, J. McK.* The Spectrum Top. Sci. n. s. 2 (895) 13.
- Cazin, A.* La Spectroscopie Paris, 1878. 12mo
- Crull, V.* Le Ombre di Venere. Astron. Nachr. 138 (1895) 366-367.
- —. Venere nel novembre 1895. Astron. Nachr. 139 (1896) 263-266.

- Combes, F.* — *La Nette australe à Mars.* *Astron. Nachr.* 122 (1897) 239, 240, 241, 242 (1897) 255-256, 243 (1897) 244-245.
- Combes, F.* — *Temps de Course, durée réelle de l'illumination des*  
*lunes (calculs) pour les* *Astron. Com.* 3, 28 (1890)  
3-12. *Beibl.* (1891) 521.
- Combes, F.* — *Sur certains plans réfringents.* *Bull. Acad. Belg.* (3)  
22 (1892) 501-512.
- Combes, F.* — *Transparence des métaux pour les rayons X.* *C.-R.*  
122 (1896) 237-238.
- Combes, F. C.* — *On a new variable star in the Aigle type.* 6442, *Z*  
*Herzberg.* *Astr. J.* 14 (1894) 125; *Astron. Nachr.* 135 (1894)  
111-112.
- — —. *New Variables.* *Astr. J.* 15 (1895) 181-182; 16 (1896)  
71-72, 107-108.
- Coppens, J. et Ch. Perrin.* — *Sur la réfraction de l'acide carbonique*  
*et du cyanogène.* *C.-R.* 103 (1886) 37; *Jahresb.* (1886) 290.
- — —. *Sur la réfraction de l'air.* *C.-R.* 102 (1886) 1461.
- Coschke, C. F. L.* — *Astronomische Studien.* *Beibl.* (1894) 99.
- — — —. *Konstruktion astronomischer Objektive.* *Viert. d.*  
*astron. Ges.* 31 (1897) 250, 253, 266-278.
- Cropper, A.* — *Sur le retard dans la perception des divers rayons*  
*spectraux.* *C.-R.* 114 (1892) 1423-1426; *Beibl.* (1893) 657.
- — —. *Changements de couleur des lumières brèves, suivant leur*  
*durée.* *C.-R.* 124 (1897) 355-359; *Beibl.* (1898) 407.
- Crommelin, H. L.* — *Ueber die Temperatur der Sonne.* *C.-R.* 114  
(1892) 737-739; *Beibl.* (1893) 566.
- Cruikshank, J.* — *Action exercée par un électro-aimant sur les spectres*  
*des gaz raréfiés, traversés par des décharges électriques.* *C.-R.*  
79 (1874) 1123; *Jahresb.* (1874) 1567.
- Child, C. D., and O. M. Stewart.* — *Most sensitive arrangement of a*  
*Wheatstone Bridge, with special reference to the Bolometer.*  
*Phys. Rev.* 4 (1897) 502-504.
- Childs, H. W.* — *Observations of a dark spot in Jupiter's N. Hemi-*  
*sphere.* *Obs'y.* (1896) 403.
- Chudron, O.* — *Photometrische Untersuchungen über die innere Dif-*  
*fusion des Lichtes.* *Bull. Acad. St. Petersburg.* 31 (1886) 213-261;  
*Beibl.* (1887) 149.
- — —. *Ueber den zweiten Kirchhoff'schen Satz.* *Repert. d. Phys.*  
24 (1888) 291-293.
- — —. *Grundzüge einer mathematischen Theorie der inneren Dif-*  
*fusion des Lichtes.* *Mélanges de St. Petersburg.* 13 (1890) 83-118;  
*Repert. d. Phys.* 26 (1890) 364-377, 385-405.

- Chwolson, O.* Gegenwartige Zustand der Actinometrie 15 (1892) 1-166; Beibl. (1893) 927.
- —. Actinometrische Untersuchungen zur Construction eines Pyrheliometers und eines Actinometers. Antwort an Hrn. Savelief. Mélanges de St. Petersb. 16 (1893) VII., 150 pp.; Beibl. (1894) 190-192.
- Cinelli, M.* Le formule generali per i fenomeni di diffrazione, etc. Nuov. Cim. (4) 1 (1895) 141-155; Beibl. (1895) 788.
- Clarke, F. W.* On the Constants of Nature. Smithsonian Contrib. (1888) 409 pp.
- Clerke, Miss A. M.* Historical and descriptive review of some double stars. Nature 39 (1888) 55-58; Beibl. (1889) 886.
- — —. Spectra of the Orion Nebula and of the Aurora. Obs'y (1889) 363-394.
- — —. New Star in the Wagoner. Astron. and Astrophys. (1892) 504-513; Beibl. (1893) 207.
- — —. Another spectroscopic binary star. Knowl. 18 (1895) 110-112.
- — —. Some anomalous sidereal spectra. Obs'y 18 (1895) 193-196.
- — —. Five short-period variables. Obs'y 19 (1896) 115-116.
- — —. A new class of variable stars. Obs'y 20 (1897) 52-55.
- Cleve, P. F.* Sur la présence de hélium dans la Clèveite. C.-R. 120 (1895) 834-835; Beibl. (1895) 568.
- — —. Sur la densité de l'hélium. C.-R. 120 (1895) 1212.
- Clifford, H. E.* Harcourt's Pentan-Unity Lamp. Technological Quar. 3 (1890) 167-169; Beibl. (1891) 34.
- Cloiseaux, Des.* Sur l'indice de réfraction du chlorure d'argent naturel. Bull. Soc. min. France 5 (1882) 25.
- Cochin, D.* Spectres de flammes de quelques métaux. C.-R. 116 (1893) 1055-1057; Beibl. (1893) 652.
- Cohen, E.* Ein neues Meteoreisen. Sitzb. Berliner Akad. (1898) 607-608.
- —. Inversionsgeschwindigkeit in Alkohol-Wassergemischen. Z. phys. Chem. (1899) 145-153.
- Cohn, E., und P. Zeemann.* Ausbreitung elektrischer Wellen im Wasser. Versl. Akad. Amsterdam 4 (1896) 108-116.
- Cohn, F.* Bahnelemente des V. Jupitermondes. Astron. Nachr. 142 (1897) 289-337.
- Coit, J. B.* Solar prominences. Astron. J. 16 (1896) 67-69.
- Colardeau.* Spectres magnétiques au moyen de substances peu magnétiques. J. de phys. 6 (1887) 83-90.

- Cole, A. D.* The refractive index and reflecting power of water and alcohol for electrical waves. *Phys. Rev.* 4 (1897) 50-60, 415.— See Mohler, *ibid.* 153.
- Collie, Michkine et Kazine.* Observations actinométriques. *Ann. chim. phys.* (6) 25 (1892) 265-286.— See Crova, *ibid.* 286-288.
- Collie and Ramsay.* Behavior of Argon and Helium submitted to the electric discharge. *Proc. Roy. Soc.* 59 (1896) 257-270.
- de Colnet-d'Huart.* Essai d'une théorie mathématique de la lumière, etc. Luxembourg: V. Buck, 1890. 106 pp. Beibl. (1891) 348.
- Colton, A. L.* Photographs of the Setting Sun. *Pub. Astron. Soc. Pac.* 7 (1895) 285.
- . Photographs of Comet Perrine. *Pub. Astron. Soc. Pac.* 8 (1896) 194.
- Comstock, G. C.* Ein einfacher aber exakter Ausdruck für die atmosphärische Refraktion. *Astron. Nachr.* 139 (1895) 135-188; Beibl. (1897) 333.
- . Application of interference methods to the determination of the effective wave-length of starlight. *Astrophys. J.* 5 (1897) 26-35.
- Conrad, E.* Atomrefractionen von Kohlenstoff, Wasserstoff und Sauerstoff. *Ztsch. physikal. Chem.* 3 (1889) 210; Jahresb. (1889) 313.
- Conroy, J.* Amount of light reflected and transmitted by certain kinds of glass. *Phil. Trans.* 180 A (1889) 245-287; Beibl. (1890) 115.
- . Change in the absorption spectra of cobalt glass produced by heat. *Proc. Phys. Soc. Feb.* 13, 1891; Beibl. (1891) 516.
- . On the refractive index of water at temperatures between 0° and 10°. *Proc. Roy. Soc.* 58 (1895) 228-234; Beibl. (1895) 881.
- . Refractive indices and densities of normal and semi-normal aqueous solutions of hydrogen chloride and the chlorides of the alkalies. *Proc. Roy. Soc.* 64 (1899) 308-318.
- Cook, C. S.* The Spectrum of Hydrogen. *Amer. J. Sci.* (3) 39 (1890) 258-268; Beibl. (1890) 782.
- Copeland, R.* New star in Auriga. *Edinburgh Trans.* 37 (1893).
- . New variable in Andromeda. *Astron. Nachr.* 139 (1895) 115 117.
- Corbino, O. M.* Fenomeno di Zeeman. *Rend. Accad. Roma* (5) 7 (1898) 241-246; Beibl. (1898) 694, 891.
- . Fenomeno di Zeeman. *Rend. Accad. Roma* 8 (1899) 250-254; *Nuov. Cim.* 9 (1899) 391-394; Beibl. (1899) 675-676.



- Corder, H.* Report of the Section for the Observation of Meteors. J. Brit. Astr. A. 4 (1895) 1-20; (1896).
- —. The Zodiacal Light. Jour. Brit. Astr. Assoc. 5 (1895) 305.
- Cornu, A.* Spectre ultraviolet de l'hydrogène. J. de phys. 5 (1886) 341-354; Beibl. (1887) 582.
- —. Étude des bandes telluriques  $\alpha$ ,  $\beta$  et  $\beta$  du spectre solaire. Ann. chim. phys. (6) 7 (1886) 5-102; Beibl. (1887) 37.
- —. Résultats numériques obtenus dans l'étude de la réflexion vitreuse et métallique des radiations visibles et ultra-violettes. C.-R. 108 (1889) 1211-1217.
- —. Sur le halo des lames épaisses, ou halo photographique, et les moyens de le faire disparaître. C.-R. 110 (1890) 551-557.
- —. Sur la limite ultra-violette du spectre solaire d'après les clichés obtenus par M. O. Simony au sommet du Ténériffe. C.-R. 111 (1890) 941-947.
- —. Ueber die Doppler-Fizeau'sche Methoden zur Bestimmung der Geschwindigkeit der Sterne in der Gesichtslinie auf spectroscopischem Wege. Beibl. (1891) 276; Ann. Bur. Longit. D. 1 (1891) 1.
- —. Sur la note de M. Joubin relative à la mesure des grandes différences de marche en lumière blanche. C.-R. 116 (1893) 711-712.
- —. Anomalies focales des réseaux diffringents. Soc. franç. de phys. (1893) 1-2, 215-223, 223-232; Beibl. (1893) 195-198; C. R. 116 (1893) 1215-1222, 1421-1428.
- —. Vérifications numériques relatives aux propriétés focales des réseaux diffringents plans. C.-R. 117 (1893) 1032-1039; Beibl. (1894) 770.
- —. Sur la caustique d'un arc de courbe réfléchissant les rayons émis par un point lumineux. C.-R. 122 (1896) 1455-1462.
- —. Sur les forces à distance et les ondulations. Ann. Bur. Longit. A. 1 (1896).
- —. Physical phenomena of the high regions of the atmosphere. Nature 53 (1896) 588-592; Beibl. (1896) 698.
- —. Les phénomènes découvertes par Zeeman. Soc. franç. de phys. (1897) 143; Astrophys. J. 6 (1897) 378-383.
- —. Quelques résultats nouveaux relatifs au phénomène découvert par M. le Dr. Zeeman. C.-R. 126 (1898) 181-187, 300; Astroph. J. 7 (1898) 163-169.
- —. The Wave-Theory of Light. Nature 6 (1899) 292-297.

- Corrigan, S. J.* Effect of pressure on the transmission of radiant energy through gaseous media. *Astron. and Astrophys.* (1892) 108-119.
- — — Radiant energy as the probable cause of the Solar Corona, the Comae and Tails of Comets and of the Aurora. *Astron. and Astrophys.* (1892) 362-367.
- Costa, T.* Brechungs- und Dispersionsvermögen bei aromatischen Verbindungen. *Gazz. chim. Ital.* (1889) 478; *Jahresb.* (1890) 390.
- — — Sul potere rifrangente moleculare delle carbilamine et delle nitrili. *Riv. sci.-industr.* 24 (1892) 104-109; *Beibl.* (1892) 424.
- Cotton, A.* Absorption inégale des rayons circulaires. *C.-R.* 120 (1895) 989-991.
- — — Absorption et dispersion de la lumière. *Ann. chim. phys.* (8) 8 (1896) 347-432; *Beibl.* (1896) 882.
- — — Procédé simple pour constater le changement de période de la lumière du sodium dans un champ magnétique. *C.-R.* 127 (1897) 865-867; *Beibl.* (1898) 352.
- — — Absorption dans un champ magnétique. *C.-R.* 127 (1898) 953-955; *Beibl.* (1899) 509.
- — — Radiation dans un champ magnétique. *Éclair. electr.* 14 (1898) 540-547.
- — — Present status of Kirchhoff's Law. *Astrophys. J.* 9 (1899) 237-268; *Rev. gén. des Sci.* 10 (1899) 102-115.
- — — Biréfringence produite par le champ magnétique, liée au phénomène de Zeeman. *C.-R.* 128 (1899) 294-297; *Beibl.* (1899) 509.
- Coupin, H.* Un céphalopode lumineux. *La Nature* 21 (1893) 99-100.
- Crew, H.* Period of rotation of the Sun as determined by the spectro-scope. *Amer. J. Sci.* (3) 38 (1889) 204-213; *Beibl.* (1890) 120.
- — — and *R. Tanall.* New method for mapping the spectra of metals. *Phil. Mag.* (5) 38 (1894) 379-386.
- — — and *O. H. Basquin.* Note on the magnesium band at  $\lambda$  5007. *Astrophys. J.* 2 (1895) 100-102; *Beibl.* (1896) 30.
- — — Note on the Spectrum of Carbon. *Astrophys. J.* 2 (1895) 103-105; *Beibl.* (1896) 29.
- — — Photographic Maps of the Metallic Spectra. *Astrophys. J.* 2 (1895) 318-320; *Beibl.* (1896) 530.
- — — Normal spectrum of the zinc arc. *Astrophys. J.* 4 (1896) 135.
- — — Provisional list of photometric units. *Astrophys. J.* 7 (1898) 298-304.



- Croft, W. B.* Spectra of various orders of colours in Newton's Scale. Proc. Phys. Soc. Dec. 16, 1892; Beibl. (1893) 1072.
- . Some observations on refraction. Phil. Mag. (5) 38 (1894) 70-81; Beibl. (1894) 1001.
- Crookes, W.* What is Yttria? Chem. News 54 (1886) 39; Jahresb. (1886) 403; C.-R. 102 (1886) 1464-1466.
- . Fractionation of Yttria. Chem. News 54 (1886) 155; Jahresb. (1886) 406.
- . Radiant Matter Spectroscopy. Proc. Roy. Soc. 40 (1886) 77, 236; Jahresb. (1886) 307.
- . Examination of the residual glow. Chem. News 55 (1887) 107-110, 119-121, 131-132.
- . Phosphorescence spectrum of the Yttrium Earths. Chem. News 55 (1887) 25; 56 (1887) 59, 62, 72, 81; Beibl. (1888) 195; Jahresb. (1887) 357.
- . Genesis of the Elements. Roy. Inst. Gr. Brit. Feb. 18, 1887.
- . Recent researches on the rare earths as interpreted by the spectroscope. Chem. News 60 (1889) 27-30, 39-41, 51-53; Beibl. (1890) 173.
- . Ueber das Spektrum des Argons. Ztsch. physikal. Chem. 15 (1894) 369-380.
- . The Spectra of Argon. Phil. Trans. 186 (1895) 243-251; Chem. News 71 (1895) 58-59; 72 (1895) 66-69 (gives the wavelengths).
- . Spectrum of the gas from Cleveite. Chem. News 71 (1895) 151; Beibl. (1895) 634.
- . Spektroskopspalt. Chem. News 71 (1895) 175; Beibl. (1895) 782.
- . Spectrum of Helium. Chem. News 72 (1895) 87-89; Beibl. (1895) 883, Astrophys. J. 2 (1895) 227-234.
- . Spectrum of Ramsay's compound of Argon and Carbon. Chem. News 72 (1895) 99; Beibl. (1896) 531.
- . The alleged new element, Lucium. Chem. News 74 (1896) 259.
- . Das Spektrum des Heliums. Ztsch. anorgan. Chem. 11 (1896) 6-13.
- . Helium in the Atmosphere. Nature 58 (1898) 570.
- . Position of Helium, Argon and Krypton in the scheme of the elements. Proc. Roy. Soc. 63 (1898) 408-411.
- . Supposed new gas Etherion. Chem. News 78 (1898) 221-223; Beibl. (1899) 203.

- Severin, H. J. J. Photographische Untersuchungen an phosphorescenten Substanzen. In: *Vierteljahrsschrift der Naturforschenden Gesellschaft in Zürich*. 1897, 45-52.
- Severin, J. P. Experiments on the light of melting platinum. *Proc. Amer. Acad.* 1896, 220-221; *Beibl.* 1897, 335-339.
- Severin, J. L'intensité actinométrique de la radiation solaire au moyen de l'actinométre photographique. *Ann. chim. phys.* 5, 14 (1888) 541-572.
- — et Houdaille. Sur l'intensité actinométrique de la radiation solaire. *C.-R.* 108 (1889) 15-17; *Beibl.* 1889, 119.
- — Mode de répartition de la vapeur d'eau dans l'atmosphère. *C.-R.* 108 (1889) 119-122; *Beibl.* 1889, 186.
- — L'analyse de la lumière diffusée par le ciel. *C.-R.* 109 (1889) 493-495; *Beibl.* 1890, 371; 1891, 36.
- — Sur l'analyse de la lumière diffusée par le ciel. *Ann. chim. phys.* 7, 20 (1890) 480-501; 25 (1892) 534-567; *Beibl.* (1891) 268.—*See Verdet. Œuvres*. IV, 815.
- — Remarques sur les observations de MM. R. Colley, H. Micheline et Kazine. *Ann. chim. phys.* 5, 25 (1892) 286-288; *Beibl.* 1892, 609.
- — Sur le bolomètre. *Ann. chim. phys.* 5, 29 (1892) 137-144; *Beibl.* 1893, 318.
- — Mesure optique des hautes températures. *C.-R.* 114 (1892) 941-943.
- — Sur les bandes d'interférence des spectres des réseaux sur gélatine. *C.-R.* 116 (1893) 672-674; *Beibl.* 1894, 193.
- — Étude photographique de quelques sources lumineuses. *C.-R.* 116 (1893) 1343-1346; *Beibl.* 1893, 1043.
- — Sur le degré d'incandescence des lampes. *C.-R.* 119 (1894) 627-630.
- — Observations actinométriques à Montpellier. *C.-R.* 122 (1896) 654-656.
- — et Houdaille. Déterminations actinométriques. *C.-R.* 123 (1896) 925-932.
- — et Complan. Le pouvoir absorbant du noir de fumée pour la chaleur rayonnante. *C.-R.* 126 (1898) 707-710; *Beibl.* (1898) 842.
- Cundall, J. T. Production von Ozon durch Flammen. *Chem. Centralbl.* (4) 1 (1890) 664.
- Curie, Mme. Skłodowska. Rayons émises par les composés de l'uranium et du thorium. *C.-R.* 126 (1898) 1101-1103.

- Curie, M. P., Mme. P. Curie et G. Bémont.* Sur une nouvelle substance fortement radio-active. C.-R. 127 (1898) 1215-1218; Beibl. (1899) 195.
- . Les rayons de Becquerel et Polonium. Rev. gén. 10 (1899) 41-50.
- Cusack, R.* Effect of change in temperature on phosphorescent substances. Nature 56 (1897) 102; Beibl. (1897) 978.
- Cushman, H.* A simplex spectroscope. Sci. n. s. 3 (1896) 45-46.
- Czapski, S.* Ueber Hasselberg's Methode, die Brennweite eines Linsensystems für verschiedene Strahlen mit grosser Genauigkeit zu bestimmen. Ztsch. Instrum. 9 (1889) 16-19, 250-252.
- . Krystalrefraktometer. Beibl. (1890) 993.

## D

- Dale, T. P.* Numerical relation between the index of refraction and the wave-length within a refractive medium, and on the limit of refraction. Phil. Mag. (5) 25 (1888) 325-338.
- . Relations between the density and the refractive powers of the gaseous elements. Phil. Mag. (5) 28 (1889) 268; Jahresb. (1889) 313.—See Rucker, Phil. Mag. (5) 28 (1889) 271.
- . Certain relations between the refractive indexes of the chemical elements. Chem. News 62 (1890) 259; Beibl. (1892) 272.
- Daubigny, H., et E. Péchard.* Sur l'efflorescence du sulfate de cuivre et de quelques autres sulfates métalliques. C.-R. 115 (1892) 171-174.
- Davis, H. S.* Confirmation of Young's Reversion Layer in the Sun. New York Acad. Sci. Trans. 16 (1896) 376.
- Décombe, L.* Méthode physique pouvant permettre de décider s'il y a ou non, dispersion dans le vide. C.-R. 128 (1899) 172-174; Beibl. (1899) 352.
- Demarçay, E.* Les terres de la Samarskite. C.-R. 104 (1887) 580.
- . Spectres des étincelles des bobines à gros fil. C.-R. 104 (1887) 678.
- . Spectres du didyme et du samarium. C.-R. 105 (1887) 276, Ber. chem. Ges. 20 (1887) 533; Chem. News 56 (1887) 114.
- . Quelques raies spectrales de l'or. C.-R. 106 (1888) 1228-1229; Beibl. (1888) 581.
- . L'analyse quantitative et la spectroscopie. Rev. gén. 4 (1893) 725-729; Beibl. (1894) 339.
- . Spectres électriques. Paris: Gauthier-Villars, 1895, 91 pp., atlas.

*Demarçay, E. (Cont'd).* Un nouvel élément contenu dans les terres rares voisines du samarium. C.-R. 122 (1896) 728-730

———. Sur le spectre et la nature du néodyme. C.-R. 126 (1898) 1039-1041.

———. Spectre d'une substance radio-active. C. R. 127 (1898) 1218.

*Denning, W. F.* Meteors of 1895. Obs'y 18 (1895) 93-94.

———. Meteors near  $\gamma$  Pegasi. Obs'y 18 (1895) 233

———. Fireball Obs'y 18 (1895) 270.

———. Bright meteor of July 7, 1895. Obs'y 18 (1895) 25-38

———. April meteors Nature 52 (1895) 33

———. The Perseids of 1895 Nature 52 (1895) 395-396.

———. The November star shower Nature 53 (1895) 7-9

———. The Planet Jupiter Nature 53 (1895) 33-34.

———. The belts and spots on Saturn. Astron. Nachr. 141 (1896) 171.

———. Two brilliant meteors Astron. Nachr. 142 (1896) 89.

———. The August meteor showers Nature 54 (1896) 415.

———. The November meteors Nature 54 (1896) 623-624

———. The Perseid Radiants, 1895 and 1896. Obs'y 19 (1896) 361-363.

———. Duration and character of the Leonid Radiant. Obs'y 20 (1897) 55-80

———. Progress of meteoric astronomy in 1896. Mon. Not. 57 (1897) 276-280

*Dennis, L. M.* A new form of discharger for spark spectra of solutions. J. Amer. Chem. Soc. 20 (1898) 1; Beibl. (1898) 218.

*Des Coudres, Th.* Handliche zur Erzeugung Lenard'scher Strahlen, und einige Versuche mit solchen Strahlen. Ann. Phys. n. F. 62 (1897) 134-144

*Deslandres, H.* Relations entre le spectre ultra-violet de la vapeur d'eau et les bandes telluriques A, B, a du spectre solaire. C.-R. 100 (1885) 854; Jahresb. (1885) 319.

———. Loi de répartition des raies et des bandes, commune à plusieurs spectres de bandes. C.-R. 104 (1887) 972-976; Beibl. (1888) 47-48.

———. Spectres des bandes ultra-violettes des métalloïdes avec une faible dispersion Ann. chim. phys. (6) 15 (1888) 5-86; Beibl. (1889) 809.

———. Détermination en longueurs d'onde de deux raies rouges du potassium. C.-R. 106 (1888) 739; Beibl. (1888) 854.

- Deslandres, H.* Spectre de bandes ultra-violet des composés hydrogénéés et oxygénés du carbone. C. R. 106 (1888) 842-856; Jahresb. (1888) 438.
- — Propriété fondamentale commune aux deux classes de spectres C.-R. 110 (1890) 748-759; Chem. News 61 (1890) 319.
- — Spectre de  $\alpha$  Lyrae C.-R. 112 (1891) 413-414; Beibl. (1891) 355.
- — Méthode nouvelle pour la recherche des bandes faibles dans les spectres de bandes. Application au spectre des hydrocarbures. C.-R. 112 (1891) 661-663.
- — Recherches nouvelles sur l'atmosphère solaire. C.-R. 113 (1891) 307-310; Beibl. (1892) 153.
- — Recherches sur le mouvement radiale des astres C. R. 113 (1891) 737-739; 115 (1893) 783-786; Beibl. (1894) 340.
- — Spectres des bandes du carbone dans l'arc électrique. Réponse à MM. Kayser et Runge. J. de phys. (2) 10 (1891) 276-281.
- — Recherches nouvelles sur l'atmosphère solaire. C.-R. 114 (1892) 276-277; Beibl. (1892) 565.
- — Résultats nouveaux sur l'hydrogène, obtenus par l'étude spectrale du Soleil. C.-R. 115 (1892) 222-225.
- — Sur la photographie de la chromosphère du Soleil. C.-R. 118 (1894) 842-844; Beibl. (1894) 915.
- — Images spéciales du soleil données par les rayons simples, qui correspondent aux raies noires du spectre solaire. C.-R. 119 (1894) 148-151; Beibl. (1895) 67.
- — Recherches sur les mouvements de l'atmosphère solaire. C.-R. 119 (1894) 457-460; Beibl. (1895) 333.
- — Recherches spectrales sur la rotation et les mouvements des planètes C.-R. 120 (1895) 417-420; Beibl. (1896) 35.
- — Rayonnement ultra-violet de la couronne solaire pendant l'éclipse totale du 16 avril 1893. C.-R. 120 (1895) 707-710; Beibl. (1895) 33.
- — Comparaison entre les spectres du gaz de la Clévite et de l'atmosphère solaire. C.-R. 120 (1895) 1112-1114; Chem. News 72 (1895) 14-15.
- — Recherches spectrales sur les anneaux de Saturne. C.-R. 120 (1895) 1155-1158.
- — Sur la vitesse radiale de  $\zeta$  Hercule. C.-R. 120 (1895) 1252.
- — Étude spectrale des charbons du four électrique C.-R. 120 (1895) 1259.

- Deslandres, H. (Cont'd).* Découverte d'une troisième radiation permanente de l'atmosphère solaire dans le gaz de la Clévéite. C. R. 120 (1895) 1331-1333. Beibl. (1895) 693.
- —. Recherches spectrales sur l'étoile Altair. C.-R. 121 (1895) 629-632. Beibl. (1896) 372. Astrophys. J. 3 (1896) 78. abs.
- —. Absorption de l'azote par le lithium à froid. C.-R. 121 (1895) 886-887.
- —. Electric origin of the solar chromosphere. Knowledge 18 (1895) 59-60.
- —. Méthode pour étudier les variations de vitesse radiale. Bull. Soc. astron. France 1 (1895) 368-373; Astron. Nachr. 139 (1896) 241-244. Astrophys. J. 3 (1896) 311-313. Beibl. (1897) 343.
- —. Observations de l'éclipse du août 1896. C.-R. 123 (1896) 978-981.
- —. Recherches sur les rayons cathodiques simples. C. R. 125 (1897) 373-375. 126 (1898) 1323-1326.
- —. Observations de l'éclipse totale de Soleil le 16 Avril 1893. Paris: Frillon, 1897, 74 pp.; Beibl. (1898) 669.
- —. Remarks on the methods employed in the determination of the radial velocities of the stars. Astrophys. J. 9 (1899) 167-172; Astron. Nachr. No. 3530 (1899).
- Detlefsen, E.* Lichtabsorption in assimilirenden Blättern. Beibl. (1889) 681.
- Dewille, E.* Theorie des Schirmes (Rasters) bei den photochemischen Processen. Trans. Roy. Soc. Canada (2) 1 III (1895) 29-61. Beibl. (1897) 418.
- Dewar, J.* Light as an analytic agent. Proc. Roy. Soc. (1887) 11 pp.; Beibl. (1889) 79.
- —. Phosphorescence and ozone. Proc. Roy. Soc. June 8, 1888; Beibl. (1890) 284.
- —. Optical peculiarities of Oxygen and Ozone. Roy. Inst. Lond. May 10, 1889; Beibl. (1890) 279.
- —. Phosphorescence and photographic effect at the boiling-point of liquid air. Chem. News 70 (1894) 252-253; Beibl. (1895) 336.
- —. Metargon. Nature 58 (1898) 319; Beibl. (1899) 395.
- —. Liquefaction of Argon and Helium. J. de phys. (3) 7 (1898) 389-393; Proc. Roy. Soc. 63 (1898) 256-258; J. Chem. Soc. 73 (1898) 528-535; Beibl. (1898) 515.
- —. Boiling Point and Density of Liquid Hydrogen. Proc. Chem. Soc. (1898) 146; C. R. 126 (1898) 1408-1412; Beibl. (1898) 515.



- Dewar, J.* Application of liquid hydrogen to the production of high vacua, together with their spectroscopic examination. *Proc. Roy. Soc.* 64 (1899) 231-238.
- . Comparative colour of the vapour of iodine in air at atmospheric pressure and in vacuum. *Proc. Cambridge Phil. Soc.* 10 (1899) 44-47.
- . (See Liveing and Dewar.)
- Dijken, D.* Molekularrefraktion und Dispersion ausserst verdünnter Salzlösungen unter Berücksichtigung der Dissociation. *Z. phys. Chem.* 24 (1897) 81-113; *Beibl.* (1897) 333, 970.
- Dimmer, G.* Absorptionsspektren von Didymsulfat und Neodymmammonitrat. *Sitzb. Wiener Akad.* 106 (1897) 1087-1102; *Beibl.* (1898) 481.
- Dittrich, R.* Ueber das Leuchten der Thiere. *Beibl.* (1888) 857.
- . Das Spectrum des Methämoglobins. *Z. anal. Chem.* (1892) 593.
- Dixon, H. B., E. H. Strange, and E. Graham.* The Explosion of Cyanogen. *J. Chem. Soc.* 69-70 (1896) 759-774.
- Dobeneck, A. von.* Das Absorptionsspectrum und die Hygroscopicität der Bodenconstituenten. *Diss., Rostock* 1892, 66 pp.
- Doberck, W.* A formula to correct double-star observations for refraction. *Obs'y* 19 (1896) 268-270.
- Donath, Br.* Bolometrische Untersuchungen über Absorptionsspektren fluorescirender Substanzen und aetherischer Oele. *Ann. Phys. n. F.* 58 (1896) 609-661.
- Dongier, R.* Méthode de mesure de la biréfringence en lumière monochromatique. *C.-R.* 122 (1896) 306-309.
- . Double réfraction accidentale du quartz par compression. *Soc. franç. de phys.* (1896) 310-311.
- . Dispersion rotatoire naturelle du quartz dans l'infra-rouge. *C.-R.* 125 (1897) 228-230; 126 (1898) 1627-1628.
- . Pouvoir rotatoire du quartz dans l'infra-rouge. *Ann. chem. phys.* (7) 13 (1898) 331-391; Paris: Gauthier-Villars, 1898, 150 pp; *Beibl.* (1899) 183-185.
- Donk, W.* Fraunhofer'sche Ringe und die Farbenerscheinungen behauchter Platten. *Ann. Phys. n. F.* 34 (1888) 801-827.
- Donnan, F. G.* Beziehung zwischen der elektrolytischen Dissociation und der Lichtabsorption in Lösungen. *Ztsch. phys. Chem.* 19 (1896) 465-488.
- . Dependence of the colour of solutions upon the nature of the solvent. *Nature* 54 (1896) 55; *Beibl.* (1896) 777.

- Dorn, E. und H. Erdmann.* Ueber das von Berthelot beschriebene Fluoreszenzspektrum des Argons. *Liebigs Ann.* 287 (1894) 230-232.
- — — Ueber das von Brush vermutete neues Gas Ethemon. *Verh. d. phys. Ges. Berlin* 17 (1894) 135-137. *Beibl.* (1899) 203.
- Doude, T. E.* Measurement of colour and the determination of white light. *Phil. Mag.* 15 46 (1898) 216-223.
- Douglas, J. E.* A cloud-like spot on the bright edge of Mars. *Astron. phys. J.* 1 (1895) 127-130. *Beibl.* (1896) 36.
- — — Nuages sur Mars. *Bull. Soc. astr. France* (1897) 290-292. *Astron. Nachr.* 142 (1897) 364-366.
- Dommer, E.* Pouvoirs réfringents des sels simples en dissolution. *C.-R.* 110 (1890) 40-42. *Jahresb.* (1890) 386.
- — — Pouvoirs réfringents des sels doubles en dissolution. *C.-R.* 110 (1890) 439-441. 957-958. *Jahresb.* (1890) 387.
- Draper, D.* Solar Spectroscopy in the infra-red. *Rept. Brit. Assoc.* (1885) 935. *Beibl.* (1888) 193.
- Draper, J. W.* On the fixed lines in the ultra-red invisible region of the spectrum. *Phil. Mag.* 15 3 (1877) 86. *Jahresb.* (1877) 195.
- Dreyer, J. L. E.* Spektralanalyse der Gestirne—See *Nature* 50 (1894) 565-567.
- — — Index Catalogue of Nebulae found in the years 1888 to 1894, with notes and corrections. *Mem. Roy. Astron. Soc.* 51 (1895) 185-228.
- Drude, P.* Absorption des Lichtes in monoklinen Krystallen. *Ztsch. f. Kryst.* 13 (1887) 567-575. *Beibl.* (1888) 359.
- — — Optische Constanten der Metalle. *Ann. Phys. n. F.* 39 (1890) 481. *Jahresb.* (1890) 385.
- — — und W. Vernt. Fluoreszenzwirkungen stehender Lichtwellen. *Götting. Nachr.* (1891) 346-358.
- — — Inwieweit genügen die bisherigen Lichttheorien den Anforderungen der praktischen Physik. *Götting. Nachr.* 11 (1892) 366-369. 393-412.
- — — Phasenänderung des Lichtes bei der Reflexion an Metallen. *Ann. Phys. n. F.* 47 (1893) 595. 51 (1894) 77. 53 (1894) 841.
- — — Zur Lichttheorie. *Ann. Phys. n. F.* 50 (1893) 381.
- — — Existence de vibrations de période plus courte à côté de l'ondulation fondamentale de l'excitateur de Hertz. *Arch. de Genève* (3) 3 (1897) 464-476.
- — — Wellenlängenmessung mit den Koharer. *Verh. deutsch. Naturf. u. Aerzte* II 1 (1899) 80.



- Drude, P.* Die optischen Konstanten des Natriums. *Ann. Phys. n. F.* 64 (1898) 159-162.
- Dubois, H. E. J. G., und H. Rubens.* Brechung und Dispersion des Lichtes in einigen Metallen. *Sitzb. Berliner Akad.* (1890) 955-968; *Rept. Brit. Assoc.* (1890) 728.
- . Magnetische Waage, bei Reflexionserscheinungen an gewissen lichtabsorbirenden Körpern. *Ver. deutsch. Naturf.* (1891) 50.
- . Reflexion und Transmission des Lichtes. *Ann. Phys. n. F.* 46 (1892) 542.
- und *H. Rubens.* Brechungsgesetz für den Eintritt des Lichtes in absorbirende Medien. *Ann. Phys. n. F.* 47 (1892) 203.
- Dubois, R.* Nouvelles recherches sur la production de la lumière par les animaux et les végétaux. *C.-R.* 111 (1890) 363-366.
- . La lumière physiologique. *Rev. des. Sci.* 5 (1894) 415-422, 529-534; *Beibl.* (1894) 1050.
- . Sur la luciférase ou zymase des animaux et des végétaux. *C.-R.* 123 (1896) 653-654; *Beibl.* (1897) 32, 590.
- Duclaux, E.* Atmosphärische Strahlenmessung und die aktinische Zusammensetzung unserer Atmosphäre. *Smithsonian Contrib.* 29 (1896) 48 pp.; *Beibl.* (1897) 983-985.
- Dudley, W. L.* The Colours and Absorption Spectra of thin metallic films and of incandescent vapours of the metals. *Chem. News* 66 (1892) 163-165; *Beibl.* (1893) 123, 206; *Amer. Chem. J.* 14 (1893) 185-190.
- Dufet, H.* Mesures comparatives d'indices par le prisme et la réflexion totale. *Bull. Soc. min. de France* 14 (1891) 130-148; *Beibl.* (1892) 25.
- . Indices de réfraction du Spath d'Islande. *Bull. Soc. min. de France*, Sept. 1893, 31 pp.
- . Propriétés optiques du calomel. *Bull. Soc. min. de France* 21 (1898) 89-94; *Beibl.* (1899) 32.
- Dufour, Ch.* Conséquences qui résultent pour la succession des ondes du déplacement d'un corps sonore ou d'un corps lumineux. *Arch. de Genève* 24 (1890) 242-255.
- et *Brunner.* Undurchsichtigkeit der Kohle. *Beibl.* (1896) 127.
- . Tubes de Crookes et rayons X. *Arch. de Genève* (4) 1 (1896) 82, 91, 111.
- . Scintillation des étoiles. *Arch. de Genève* (4) 1 (1896) 172; *Astrophys. J.* 3 (1896) 314.

- Dufour, Ch. (Cont'd).* Comparaison entre la lumière du Soleil et celle de quelques étoiles. Arch. de Genève (4) 7 (1899) 209-217.
- Dunér, N. C.* Revolution of the Sun (observed with a Rowland grating). Oefvers. Stockholm Akad. Forh. 47 (1890) 17-21; Beibl. (1890) 621; (1892) 430.
- — —. Y a-t-il de l'oxygène dans l'atmosphère du Soleil? C.-R. 117 (1893) 1056-1059; Astron. and Astrophys. 13 (1894) 215-218; Beibl. (1894) 562.—See Schuster, C. R. 118 (1894) 137-138.
- — —. Periodic changes in the variable star Z Herculis. Astrophys. J. 1 (1895) 285-294; 3 (1896) 348-350; Astron. Nachr. 140 (1896) 261-263.
- — —. Die Spectra von Sternen der Klasse III. b. Astrophys. J. 9 (1899) 119-132; Beibl. (1899) 790.
- Dussaud, F.* Réfraction et dispersion du chlorate de soude cristallisé. C.-R. 113 (1891) 291-292; Beibl. (1892) 23, 26.
- — —. Transmission des sons par les rayons ultra-violet. C.-R. 128 (1899) 171.
- 
- Easton, C.* The Great Nebula in Andromeda. Nature 50 (1894) 547.
- — —. Distance of the Stars in the Milky Way. Knowledge 18 (1895) 179-182; Astrophys. J. 1 (1895) 216-221; Beibl. (1896) 39.
- Ebert, H.* Abhängigkeit der Wellenlänge des Lichtes von seiner Intensität. Ann. Phys. n. F. 32 (1887) 337-384.
- — —. Einfluss der Schwellenwerthe der Lichtempfindung auf den Character der Spectra. Ann. Phys. n. F. 33 (1888) 136-159.
- — —. Einfluss der Dicke und Helligkeit der strahlenden Schicht auf das Aussehen des Spectrums. Ann. Phys. n. F. 33 (1888) 155-159.
- — —. Methode der hohen Interferenzen. Ann. Phys. n. F. 34 (1888) 39-91.
- — —. Optische Mittheilungen. Beibl. (1889) 942-944.
- — —. Anwendung des Doppler'schen Principes auf leuchtende Gasmoleculen. Ann. Phys. n. F. 36 (1889) 466-473.
- — —. Bemerkung zu Hrn. Langley's Aufsatz: "Energy and Vision." Ann. Phys. n. F. 36 (1889) 592.—See S. P. Langley, Amer. J. Sci. (3) 36 (1888) 359.
- — —. Zur Beleuchtungstheorie. Naturforsch. Vers. 62 (1889) 200; Beibl. (1891) 642.
- — —. Zwei Formen von Spectrographen. Ann. Phys. n. F. 38 (1889) 489-494.
- — —. Wesen der Flammenstrahlung. Jahrb. f. Photogr. 5 (1891) 592-600; Beibl. (1891) 280.

- Ebert, H.* Die Mechanik des Leuchtens. Beibl. (1891) 643.
- —. Electromagnetische Theorie der Sonnencorona. *Astron and Astrophys.* 12 (1893) 804-810; Beibl. (1894) 339.
- —. Photographische Fixirung magnetischer Kraftlinien. *Jahrb. f. Photogr.* (1896) 126-128.
- Eddie, L. A.* Colors and spectra of one hundred southern stars. *Jour. B. A. A.* 5 (1894) 89-98.
- — —. The short-period variable  $\delta$  Cephei. *Astrophys. J.* 3 (1896) 227.
- Edelmann, M. Th.* Eisendrahtbolometer zur Untersuchung von Wärmespectren. Beibl. (1894) 749.
- Eder, J. M.* Wirkung verschiedener Farbstoffe auf das Verhalten des Bromsilbers gegen das Sonnenspectrum. *Sitzb. Wiener Akad.* 92 II. (1885) 1346; 93 (1886) 4; 94 (1887) 75.
- — —. Mittheilung über das sichtbare und ultraviolette Emissionsspectrum schwachleuchtender verbrennender Kohlenwasserstoffe (Swan'sches Spectrum) und der Oxyhydrogenflamme (Wasserdampfspectrum). *Monatshefte f. Chem.* 11 (1890) 151-153; *Wiener Anzeiger* (1890) 103-105.
- — —. Neue Banden und Linien im Emissionsspectrum der Ammoniak-Oxygenflamme. *Wiener Anzeiger* (1892) 44-47.
- — — und *E. Valenta*. Einige neue Linien im brechbarsten ultravioletten Emissionsspectrum des metallischen Calciums. *Wiener Anzeiger* (1892) 252-253; Beibl. (1893) 444.
- — —. Ueber das Linienspectrum des elementaren Kohlenstoffes im Inductionsfunken, und über das ultraviolette Funkenspectrum nasser und trockener Holzkohle. *Wiener Anzeiger* (1893) 21-24.
- — —. Emissionsspectrum des Kohlenstoffes und des Siliciums. *Denkschr. d. Wiener Akad.* 60 (1893) 241-262; Beibl. (1894) 753-756.
- — —. Ultra-violette Spectrum des elementaren Bor. *Denkschr. d. Wiener Akad.* 60 (1893) 307-311; Beibl. (1894) 752.
- — —. Verlauf der Bunsen'schen Flammenreactionen im ultravioletten Spectrum. *Denkschr. d. Wiener Akad.* 60 (1893) 467-476.
- — —. Beiträge zur Spectralanalyse. I. Das Emissions-spectrum der Ammoniakoxygenflamme. II. Die Verwendbarkeit der Funkenspectren verschiedener Metalle zur Bestimmung der Wellenlänge im Ultravioletten. *Denkschr. d. Wiener Akad.* 60 (1893) 24 pp.; Beibl. (1894) 910-912.

- Eder, J. M., und E. Valenta (Cont'd). Ueber das Spectrum des Kaliums, Natriums und Cadmiums bei verschiedenen Temperaturen. Denkschr. d. Wiener Akad. 61 (1894) 347-364; Beibl. (1894) 1046.
- , —. Die verschiedenen Spectren des Quecksilbers. Ann. Phys. n. F. 55 (1895) 478-502. Denkschr. d. Wiener Akad. 61 (1894) 30 pp.
- , —. Absorptionsspectren von farblosen und gefärbten Gläsern mit Berücksichtigung des Ultraviolett. Denkschr. d. Wiener Akad. (1894) 285-295.
- , —. Remarks upon orthochromatic photography and the methods of spectrographic test. Brit. J. Photogr. 42 (1895) 391-392.
- , —. Ultraviolette Absorptions- und Emissionsspektren. Verh. deutsch. Naturf. u. Aerzte II. 1 (1895) 78.
- , —. Bemerkung zu Hrn. Bohn. "Ueber Flammen und leuchtende Gase". Ztsch. phys. Chem. (1896) 20-24; Beibl. (1896) 276.
- , —. Spectren von Kupfer, Silber und Gold. Denk. d. Wiener Akad. 63 (1896) 47 pp.; Beibl. (1898) 366; Astroph. J. 3 (1896) 311-313.
- , —. Spectralanalytische Untersuchungen des Argons. Denk. d. Wiener Akad. 64 (1896) 39 pp.; Beibl. (1897) 129.
- , —. Drei verschiedene Spectren des Argons. Monatsh. d. Chem. (1896) 50-57; Astroph. J. 3 (1896) 396-398; Beibl. (1896) 531.
- , —. Das rothe Spectrum des Argons. Monatsh. f. Chem. 16 (1895) 893-895; Beibl. (1896) 126.
- , —. Das Linienspektrum des Siliciums. Sitzb. Wiener Akad. 107 (1897) 41-43.
- , —. Ueber das Funkenspektrum des Calciums und Lithiums und seine Verbreitungs- und Umkehrungserscheinungen. Denk. d. Wiener Akad. (1898) 11 pp.; Beibl. (1899) 250.
- , —. Linienspektrum des Siliciums. Sitzb. 107 IIa (1898) 41-43; Wiener Anzeiger (1898) 4.
- , —. Die Spectren des Schwefels. Denk. d. Wiener Akad. 67 II. (1898) 55 pp.; Beibl. (1898) 773.
- , —. Spektralanalyse der Leuchtgasflamme. Denk. d. Wiener Akad. 67 II (1898) 12 pp.; Beibl. (1899) 251, 557.
- , —. Spectrum des Chlors. Wiener Anzeiger (1898) 252-253.

- Eder, J. M., and E. Valenta.* Spektrum des Broms. Wiener Anzeiger (1899) 225.
- Edison, E. A.* Fluoroscope. Electrician 36 (1896) 834-835.
- Edser, E., and Butler, C. P.* Simple method of reducing prismatic spectra. Phil. Mag. (5) 46 (1898) 207-216; Chem. News (1898) 260.
- Edwards, W. F.* New formula for specific and molecular refraction. Amer. Chem. J. 16 (1894) 625-634; Beibl. (1895) 420.
- — —. Molecular and Atomic Refraction. Amer. Chem. J. 17 (1895) 473-506; Beibl. (1896) 364.
- Ehlers, J.* Absorption des Lichtes in einigen pleochroitischen Krystallen. Diss. Göttingen 1897; Beibl. (1898) 157.
- Eisig, L.* Das Linienspectrum des Sauerstoffs. Ann. Phys. n. F. 51 (1894) 747.
- Ekama, H.* Berechnung der Constanten  $\alpha'$  in der Airy'schen Theorie des Regenbogens. Beibl. (1890) 625.
- — —. Die Kurven, welche beim Halo den kleinen Kreis um den Himmelskörper berühren. Beibl. (1898) 155.
- Elger, T. G.* Selenographic notes. Obs'y 19 (1896) 156-158, 199-201, 236 238, 267 268, 302-308, 328-330, 363-364.
- Ellerman.* Red Region of Jupiter. Astrophys. J. 9 (1899) 186; Yerkes Observ. Bull. No. 6.
- Ellinger, H. O. G.* Optische Analyse von Butterfette. J. prakt. Chem. (1891) 157-159.
- — —. Optische Bestimmung der Albuminmenge. J. prakt. Chem. (1891) 256.
- Elster, J., and H. Geitel.* Beobachtungen des atmosphärischen Potentialgefällers und der ultravioletten Sonnenstrahlung. Separatabdr. d. Wiener Akad. 10 (1892) 703-856; Wiener Anzeiger (1892) 43.
- — —. Vergleichung von Lichtstärken auf photographischem Wege. Ann. Phys. n. F. 48 (1893) 625.
- — —. Abhängigkeit des photoelektrischen Stromes vom Einfallswinkel (etc.). Ann. Phys. n. F. 61 (1897) 445-465.
- — —. Photoelektrische Eigenschaft von Salzen. Ann. Phys. n. F. 62 (1897) 599-602.
- — —. Versuche über Hyperphosphoreszenz. Jahresb. Ver. Naturwiss. Braunschweig 10 (1897) 7 pp.
- Emden, R.* Lichtemission glühender Körper. Ann. Phys. n. F. 36 (1889) 214-236.
- Engel.* Sur les variations de couleur du chlorure de cobalt. Bull. Soc. chim. Paris (3) 6 (1891) 239-251.



*Engel (Cont'd).* Sur deux nouveaux états du soufre. C.-R. 112 (1891) 866-868.

*Engelmann, Th. W.* Tafeln und Tabellen zur Darstellung der Ergebnisse spektroskopischer und spektrometrischer Beobachtungen. Leipzig: W. Engelmann, Leipzig, 1897; Phys. Rev. 6 (1898) 183.

*Englisch, F.* Ueber die Gültigkeit des Bunsen Roscoe'schen Gesetzes bei intermittirender Belichtung von Bromsilbergelatine. Verh. deutsch. Naturf. (1899) 171-172.

*Eppler, A.* Beziehungen zwischen dem Krystall und seinem chemischen Bestande. Ztsch. f. Kryst. u. Min. 30 (1898) 118-176.

*Erdmann, H.* Farbige Abbildung der Emissionsspectra. Naturwiss. Rund. 13 (1898) 465-467, Beibl. (1898) 840.

*Erhard, Th.* Beobachtung am Bunsen'schen Photometer. Beibl. (1890) 372.

*Espin, T. E.* Spectrum of  $\alpha$  Herculis. Astron. and Astroph. (1894) 651.

— — —. Sterne mit bemerkenswerthen Spectren. Astron. Nachr. (1887) 48-52.

— — —. Sterne mit bemerkenswerthen Spectren. Astron. Nachr. 122 (1889) 257-259.

— — —. Spectrum of R Andromedae. Nature 40 (1889) 656; Beibl. (1890) 284.

— — —. Sterne mit bemerkenswerthen Spectren. Astr. Nachr. 124 (1890) 177-180.

— — —. Aenderung der Spectra von R Coronae und R Scuti. Naturwiss. Rundsch. 6 (1891) 151.

— — —. Photo-Stellar Spectra. Nature 44 (1891) 133-134.

— — —. Some new red stars and suspected variable stars. Eng. Mech. 62 (1895) 334.

— — —. Sterne mit bemerkenswerthen Spectra. Astron. Nachr. 137 (1895) 369-375.—See F. Krueger, Astron. Nachr. 138 (1895) 111.

— — —. Stars with remarkable spectra. Astron. Nachr. 140 (1896) 241-251.

— — —. Position of the stars of Type IV and of the variable stars of Type III in reference to the Milky Way. Astrophys. J. 10 (1899) 169-172.

*Etard, A.* Coloration des solutions de cobalt, et l'état des sels dans les solutions. C.-R. 113 (1891) 699-701.

— — —. L'origine moléculaire des bandes d'absorption des sels de cobalt et de chrome. C.-R. 120 (1895) 1057-1060.

- Etard, A.* Le spectre des chlorophylles. C.-R. 123 (1896) 824-828; 124 (1897) 1351-1354.  
 ——. Dédoublément de la bande fondamentale des chlorophylles. C.-R. 124 (1897) 1351-1355.  
*Evershed, J.* Corona Spectrum. Nature 48 (1893) 268; Beibl. (1894) 563.  
 ——. Electric origin of the chromosphere. Knowledge 18 (1895) 39.  
 ——. Solar Spectroscopic Report for 1894. Jour. B. A. A. 5 (1895) 345-349.  
 ——. Experiments on the radiation of heated gases. Phil. Mag. (5) 39 (1895) 460-476; Beibl. (1895) 882.  
*Ewan, T.* Absorption spectra of some copper salts in aqueous solution. Phil. Mag. (5) 33 (1892) 317-342; Beibl. (1893) 37.  
 ——. Absorption spectra of dilute solutions. Proc. Roy. Soc. 56 (1894) 286-288; Beibl. (1894) 998.  
 ——. Absorption spectra of dilute solutions. Proc. Roy. Soc. 59 (1895) 117-161.  
*Exner, F.* Photometrie der Sonne Sitzb. Wiener Akad. 94 II (1886) 345-356.  
*Exner, K.* Fliegende Schatten und Baily's Beads. Astron. Nachr. (1887) 321-324; Beibl. (1887) 671.  
 ——. Eine Consequenz des Fresnel-Huyghen'schen Principes. Sitzb. Wiener Akad. (1889) 51-54.  
 ——. Windrichtung und Scintillation. Meteorolog. Ztschr. 13 (1896) 401-404; 14 (1897) 156.  
 ——. und *E. Haschek*. Ueber die ultravioletten Funkenspectra der Elemente Mit 21 Tafeln. Sitzb. Wiener Akad. 104 IIa (1895) 909-962; 105 IIa (1896) 389-436, 503-574, 707-740, 989-1013; 106 IIa (1897) 36-68, 337-356, 1127-1152; 107 IIa (1898) 182-206, 792-812, 818-837, 1335-1380.  
*Eykmann, J. F.* Recherches réfractométriques. Rec. des Trav. des Pays-Bas 12 (1893) 268-286; 15 (1896) 52-61; Ber. chem. Ges. 25 (1892) 3069-3080; Beibl. (1893) 104-108; (1897) 27.

## F

- Fabre, C., et Andoyer.* Sur l'emploi des plaques orthochromatiques en photographie astronomique C. R. 113 (1891) 60-62.  
 ——. Visibilité périodique des phénomènes d'interférence. C.-R. 111 (1890) 600-602, 788-790; Beibl. (1891) 214.

- Fabre, C.* (Cont'd). Théorie de la visibilité et de l'orientation des franges d'interférence. Thèse. Paris 1892. 100 pp.; J. de phys. (3) 1 (1892) 313-332; Beibl. (1892) 668; (1893) 341.
- —. Propagation anormale des ondes lumineuses et les anneaux de Newton. J. de phys. (3) 2 (1893) 22-27; C.-R. 115 (1892) 1063-1064.
- — et *Perot, A.* Mesure de petites épaisseurs en valeur absolue. C.-R. 123 (1896) 802-805.
- —. Sur les franges des lames minces argentées et leur application à la mesure de petites épaisseurs d'air. Ann. chim. phys. (7) 12 (1897) 459-501; Beibl. (1898) 565-567.
- —. Un spectroscopie interférentiel. C.-R. 126 (1898) 331-335, 407.
- —. Méthode de détermination du numéro d'ordre d'une frange d'ordre élevé. C.-R. 126 (1898) 1561-1564; 1624-1626; Beibl. (1899) 30.
- —. Étude des radiations du mercure et la mesure de leurs longueurs d'onde. C.-R. 126 (1898) 1706-1708.
- —. Théorie et applications d'une nouvelle méthode de spectroscopie interférentielle. Ann. chim. phys. (7) 16 (1899) 115-144.
- —. Sur une source intense de lumière monochromatique. C.-R. 128 (1899) 1156-1158; Beibl. (1899) 635.
- —, *Marc de Lepinay*, et *A. Perot*. Mesure en longueurs d'onde des dimensions d'un cube de quartz de 4 cm. de côté. C.-R. 128 (1899) 1317-1320.
- Fahrig, E.* Die durch Berührung von Ozon mit gewissen Flüssigkeiten hervorgerufene Phosphoreszenz. Beibl. (1890) 1103; Chem. News 62 (1890) 39.
- Fargis, G. A.* The Photochronograph applied to measures of double stars and planets. Georgetown Observatory, Washington, D.C., 1894. 28 pp.
- Fauth, P.* Ueber das Aussehen des Planeten Jupiter. Astron. Nachr. 140 (1896) 167.
- —. Saturn, 1896. Astron. Nachr. 141 (1896) 401-403.
- —. Bemerkenswerthe neue selenographische Formen. Sirius 24 (1896) 169.
- —. Flecke auf Jupiter. Astron. Nachr. 142 (1897) 375.
- Faye, H.* Nouvelles études sur la rotation du Soleil. C.-R. 111 (1890) 77-92.
- Fényi, J.* Sur deux éruptions sur le soleil. C.-R. 109 (1889) 132-133; Beibl. (1889) 885.



- Fényi, J.* Ueber die gegenseitige Zusammennahme der Sonnenthatigkeit. *Astron. Nachr.* 126 (1890) 113-116; *Beibl.* (1891) 770.
- —. Vitesse énorme d'une protubérance solaire observée le 17 juin, 1891. *C.-R.* 113 (1891) 310-313, *Beibl.* (1891) 107.
- —. Nouvelle interprétation du phénomène des protubérances solaires. *C.-R.* 121 (1895) 931-933. *Astron. Nachr.* 140 (1896) 289-302; *Beibl.* (1896) 699.
- —. Considérations sur la nature des protubérances solaires ordinaires. *C.-R.* 122 (1896) 72-80; *Beibl.* (1896) 699.
- — —. Protuberanze e facole solari. *Mem. Spettro. Ital.* 25 (1896) 115-124, 225-226; *Astrophys. J.* 4 (1896) 263-264.
- Ferrel, W.* Weber's Law of the Radiation of Heat. *Amer. J. Sci.* (3) 39 (1890) 137-145; *Beibl.* (1890) 981.
- —. Measures of the intensity of solar radiation. *Amer. J. Sci.* (3) 41 (1891) 378-386; *Beibl.* (1891) 645.
- Ferry, E. S.* The use of the sectored disc in photometry. *Phys. Rev.* 1 (1894) 338-346; *Beibl.* (1894) 747.
- — —. Relation between pressure, current, and luminosity of the spectra of pure gases in vacuum tubes. *Phys. Rev.* 7 (1898) 1-9; *Beibl.* (1898) 900.
- — —. Photometric study of the spectra of gases at low pressures. *Phys. Rev.* 7 (1898) 296-307; *Beibl.* (1899) 251.
- Féry, C.* Sur un nouveau réfractomètre. *C.-R.* 113 (1891) 1028-1030.
- —. Application de l'auto-collimation à la mesure des indices de réfraction. *C.-R.* 119 (1894) 402-404; *Beibl.* (1895) 168.
- —. Du rôle de la diffraction dans les effets obtenus avec les réseaux ou trames photographiques. *C.-R.* 126 (1898) 333-335.
- Fessenden, R. A.* Some recent work on molecular physics. *J. Franklin Inst.* 140 (1896) 187-216.
- — —. Outline of an electrical theory of comets' tails. *Astrophys. J.* 3 (1896) 36-40.
- Festing* Absorption spectra of pure compounds. *Rept. Brit. Assoc.* (1889) 227-228.
- Feussner* Bestimmung der Winkel- und Brechungsexponenten von Prismen mit Fernrohr und Scala. *Sitzb. Ges. Marburg*, Feb. 3, 1888.
- Fizez, Ch.* Les changements de réfrangibilité observés dans les spectres électriques de l'hydrogène et du magnésium. *Bull. Acad. Belg.* (3) 7 (1884) 245, *Jahresb.* (1884) 293.
- —. De l'influence du magnétisme sur les caractères des raies spectrales. *Bull. Acad. Belg.* (3) 9 (1885) 381; *Jahresb.* (1885) 319.

- Fizez, Ch. (Cont'd).* Nouvelles recherches sur le spectre du carbone. Bull. Acad. Belg. 14 (1887) 100-107; Beibl. (1888) 102.
- —. Nouvelles recherches sur l'origine optique des raies spectrales, en rapport avec la théorie ondulatoire de la lumière. Bull. Acad. Belg. 15 (1888) 81-86.
- —. Analyse optique de la flamme d'une bougie. Ann. Observat. Bruxelles 1888, 10 pp.; Beibl. (1888) 246.
- —, et *E. van Aubel*. L'intensité des bandes d'absorption des liquides colorés. Soc. franc. de phys. (1889) 2-3; Bull. Soc. Belg. (3) 17 (1889) 102-104; Beibl. (1889) 501.
- Filon, L. V. G.* Certain diffraction fringes as applied to micro-metric observations. Phil. Mag. (5) 47 (1899) 441-461; Beibl. (1899) 559.
- Finsterwalder, S.* Die von optischen Systemen grösserer Oeffnung und grösseren Gesichtsfeldes erzeugten Bilder. Abh. Münchener Akad. 17 (1891) 519-587; Beibl. (1892) 204-209.
- —. Die geometrischen Grundlagen der Photogrammetrie. Jahresb. d. deutsch. Math. Ver. 6 (1899) 1-42, Heft 2.
- Fischer, O.*, und *M. Busch*. Ueber eine neue Klasse von fluorescirenden Farbstoffen der Chinoxalinreihe. Ber. chem. Ges. 24 (1891) 1870-1874.
- Fitzgerald, F. G.* Nomenclature of radiant energy. Nature 49 (1893) 149; Beibl. (1894) 669.
- — —. Some considerations showing that Maxwell's Theorem of the Equal Partition of Energy among the degrees of freedom of atoms is not inconsistent with the various internal movements exhibited by the spectra of gases. Proc. Roy. Soc. 57 (1895) 312-314.
- — —. Note on a cause for the shift of spectral lines. Astroph. J. 5 (1897) 210-211.
- — —. Converse of the Zeeman Effect. Nature 59 (1898) 222.
- — —. Experiment to illustrate the Zeeman Effect. Nature 59 (1898) 509, 557.
- Fizeau, A. H. L.* Remarques sur l'influence que l'aberration de la lumière peut exercer sur les observateurs des protubérances solaires par l'analyse spectrale. C.-R. 113 (1891) 353-356; Beibl. (1892) 154.
- — —. Remarques sur la constance moyenne d'éclat des principales étoiles. C.-R. 121 (1895) 516.
- Flamache, A.* Note sur une méthode de détermination de la parallaxe des étoiles doubles. Bull. Soc. Belg. d'Astron. 1 (1896) 45-49.

- Flamache, A.* Note sur les moyens d'observer les protubérances solaires. Bull. Soc. Belg. d'Astron. 1 (1896) 83-91.
- — Le Stellomètre. Bull. Soc. Belge d'Astron. 1 (1896) 204-207.
- Flammarion, C.* Les neiges polaires de Mars. C.-R. 119 (1894) 786-791; 121 (1895) 760-763. Bull. Soc. d'Astron. France (1897) 113-118; Astron. Nachr. 142 (1896) 31, 159.
- — Le bolide de Madrid. Bull. Soc. d'Astr. France 2 (1896) 73-78.
- — La Grande Nebuleuse d'Orion. Bull. Soc. astr. France (1897) 209-212.
- Flanery, D.* Fluctuations of Mira Ceti. Knowledge 18 (1895) 182-183.
- Fleming, J. A.* A further examination of the Edison Effect in glow lamps. Phil. Mag. (5) 41 (1896) 52-102.
- Fleming, M. L.* Sterne mit eigenthümlichen Spectren. Astron. Nachr. 125 (1890) 155-156, Beibl. (1891) 208.
- — Stars having peculiar spectra. Astron. Astroph. 12 (1893) 810-811; 13 (1894).
- — Stars having peculiar spectra. Astrophys. J. 1 (1895) 411-415; 2 (1895) 354-359; Astron. Nachr. 137 (1895) 71-74; Beibl. (1896) 700.
- — Seven new variables. Astrophys. J. 2 (1895) 198-201.
- — New variable stars discovered from the Henry Draper Memorial photographs. Harvard Observ. Cir. 6 (1896); Astrophys. J. 3 (1896) 296-302.
- — Stars of the Fifth Type in the Magellanic Clouds. Astrophys. J. 8 (1898) 232.
- — Classification of the spectra of variable stars of long period. Astrophys. J. 8 (1898) 233.
- Folk, A.* Krystallographisch-chemische Untersuchungen. Ztsch. f. Kryst. u. Min. 17 (1889) 368-383, 578-591.
- — Krystallographisch-chemische Tabellen. Leipzig: Engelmann 1890, 94 pp.; Ztsch. Kryst. u. Min. 18 (1890) 599-610 Abs.
- — Beiträge zur Kenntniss der Beziehungen zwischen Krystallform und chemischer Zusammensetzung. Ztsch. f. Kryst. u. Min. 20 (1892) 76-84.
- — Krystallographisch-chemische Untersuchungen. Ztsch. f. Kryst. u. Min. 20 (1892) 332-344; 21 (1893) 29-42; 25 (1895) 334-349.
- Förster, F.* Das chemische Verhalten des Glases. Ber. chem. Ges. (1892) 2494-2518.

- Foerster, O.* Die Elasticitätscoefficienten und die Wellenbrechungsercheinungen als Functionen der Molekulargewichte und specifischen Wärme. Ztsch. f. Math. u. Phys. 41 (1896) 258-265.
- Foley, A. L.* Arc Spectra. Phys. Rev. 5 (1897) 129-152. (Calcium, Carbon, Cyanogen.)
- Fomm, L.* Die Wellenlangen der Röntgenstrahlen. Sitzb. Muenchener Akad. (1896) 4 pp.; Naturwiss. Rundschau 11 (1896) 304.
- Foote, W. M.* Note on a new meteorite from the Sacramento Mts., New Mexico. Amer. J. Sci. (4) 3 (1897) 65-66; Nature 55 (1897) 572-573.
- de Forcrand et Sully, Thomas.* Sur la formation des hydrates mixtes de l'acétylène et de quelques autres gaz. C.-R. 125 (1897) 109-111.
- Forel, F. A.* Am Genfer.—See beobachtete Refraktionen und Luftspiegelungen. Beibl. (1897) 511.
- Forsling, S.* Om Absorptionsspektra hos Didym och Samarium i det ultraviolette spektret. Bih. Svensk. Akad. Handl. 18 I. (1893) 23 pp.; Beibl. (1894) 562.
- . Die Absorptions- und Emissionsspektra des Praseodidym. Bih. Svensk. Akad. Handl. 23 I. (1898) No. 5; Beibl. (1899) 484.
- . Om Absorptionsspektra hos Erbium, Holmium och Thulium. Bih. Svensk. Akad. Handl. 24 II. (1898) 1-35.
- Foussereau, G.* Sur l'entraînement des ondes lumineuses par la matière en mouvement. J. de phys. (3) 1 (1892) 144-147; Beibl. (1892) 603.
- . L'entraînement des ondes lumineuses par la matière en mouvement. C.-R. 120 (1895) 85-88.
- Fowle, F. E.* Longitudinal aberration of prisms. Amer. J. Sci. (4) 2 (1896) 255-258.
- Fowler, A.* Variable stars and the constitution of the sun. Nature 38 (1888) 492-493; Beibl. (1889) 885.
- . The Draper Catalogue of Stellar Spectra. Nature 45 (1892) 427-428.
- . Spectrum of lightning. Nature 46 (1892) 268.
- . A new classification of stellar spectra. Nature (1897) 206-208.
- Franklin, W. S.* The fundamental law of temperature for gaseous celestial bodies. Sci. n. s. 9 (1899) 594-595.
- Franks, W. S.* The spectra and colours of stars. Jour. B. A. A. 5 (1895) 455-458.
- Fraunhofer, Joseph von.* Gesammelte Schriften, gesammelt von E. Lommel. Muenchen, Verlag der Akademie, 1888; Beibl. (1889) 255-256.

- Freeman, F. H.* Spectrum of potassium and barium. *Chem. News* 18 (1868) 1.
- Fresnaye, H. de la.* Méthode Doppler-Fizeau. *C.-R.* 115 (1892) 1289-1292; *Beibl.* (1893) 916.
- Fric, Josef und Jan.* Photographische Aufnahmen von Cometen. *Astron. Nachr.* 140 (1896) 63-64, 253.
- Friedel, Ch.* Absorption der strahlenden Wärme durch Flüssigkeiten. *Ann. Phys. n. F.* 55 (1895) 453-478.
- Friedel, G.* Observations relatives à la Note de M. Dongier sur un procédé de mesure des biréfringences. *C.-R.* 122 (1896) 1051-1052.
- Friedlaender, S.* Ueber Argon. *Ztsch. physikal. Chem.* 19 (1896) 657-667.
- Friedrich, E.* Entdeckung der therapeutischen O-Strahlen. *Wiener Anz.* (1898) 2.
- Frohlüh, O.* Messungen der Sonnenwärme. *Ann. Phys. n. F.* 30 (1887) 582 620.
- . Absorption der Sonnenwärme in der Atmosphäre. *Meteorolog. Ztsch.* 5 (1888) 382 390; 6 (1889) 78; *Beibl.* (1889) 504, 687.
- Frost, E. B.* Note on a differential method of determining the velocity of stars in the line of sight. *Astrophys. J.* 2 (1895) 235-236; *Beibl.* (1896) 371.
- . Note on Helium in Beta Lyrae. *Astrophys. J.* 2 (1895) 383-384.
- . Helium astronomically considered. *Pub. A. S. Pac.* (1895) 317-326.
- . Note on Mr. Lewis E. Jewell's letter on Dr. Arendt's spectroscopic investigation of the variation of aqueous vapor in the atmosphere. *Astrophys. J.* 5 (1897) 279; *Astrophys.* 6 (1897) 57.
- . The variable velocity of Polaris. *Astrophys. J.* 10 (1899) 184 185.
- . Titanium for a comparison spectrum. *Astrophys. J.* 10 (1899) 207.
- . Corrections to determinations of absolute wave-length. *Astrophys. J.* 10 (1899) 283.
- Fuchs, P.* Ueber elektrische Entladungsröhren zur wissenschaftlichen Spektralanalyse und deren Herstellung. *Z. f. Glasinstrum.* 6 (1897) 174 177; 7 (1897) 4-7; *Beibl.* (1898) 218.
- Fuchs, S., und Kriedl, A.* Ueber das Verhalten des Sehpurpurs gegen die Röntgen'schen Strahlen. *Centralbl. f. Physiol.* (1896) Heft 9.



- Fuchtbauer*. Demonstration eines Fraunhofer'schen Original-apparates für Brechung und Farbenzerstreuung. Verh. deutsch. Naturf. u. Aerzte 65 (1893) 19-22

## G

- Gale, W. F.* The meteor of Sunday, March 24, 1895. Jour. B. A. A. 5 (1895) 407
- Galitzin, B.* Theorie der Verbreiterung der Spectrallinien. Bull. Akad. St. Petersburg 5 II (1895) 397-417. Ann. Phys. n. F. 50 (1895) 78-99
- Methode zur Bestimmung von Brechungsexponenten in der Nähe des kritischen Punktes. Bull. Akad. St. Petersburg (5) 3 (1895) 131. Beibl. (1896) 122
- Gimgey, Arthur*. Sur l'absorption des rayons ultra violets et violets par l'hémoglobine ses combinaisons et quelques-unes des substances qui en dérivent. Arch. de Genève (3) 34 (1895) 585-588. Beibl. (1896) 650-696. Proc. Roy. Soc. 49 (1896) 276-279
- Garbasso, I.* Sulla luce bianca. Atti Accad. Torino 30 (1895) 100-107. Beibl. (1895) 488. Nuov. Cim. (4) 1 (1895) 305-308
- Sulla doppia rifrazione dei raggi di forza elettrica. Nuov. Cim. (4) 2 (1895) 120-122. Atti Accad. Roma 5 (1896) 8-10
- Sopra un punto della teoria dei raggi catodici. Rend. Accad. Roma 5 (1896) 250-254
- Sopra alcuni fenomeni luminosi presentati dalle scaglie di certi insetti. Mem. Accad. Torino 46 (1896) 179-180. Beibl. (1896) 985
- La forme de la perturbation dans un rayon de lumière solaire. Arch. de Genève (5) 3 (1897) 105-113. Nuov. Cim. (4) 6 (1897) 313-322
- Ueber die Interpretation gewisser Versuche von P. Zeeman. Beibl. (1898) 433; Nuov. Cim. (4) 6 (1897) 8-14.
- Su le modificazioni, che i raggi della luce producono in certe sostanze coloranti. Nuov. Cim. 8 (1898) 264-265
- Guth, W.* Photometrie der ultravioletten Strahlung der Sonne. Verh. deutsch. Naturf. u. Aerzte 63 (1890) 50
- Gummell, S. M. B.* The Zodiacal Light. Jour. B. A. A. 5 (1895) 216-217, 306, 360.
- The Milky Way. Jour. B. A. A. 5 (1895) 303-305
- Gennari, G.* Sul potere rifrangente dell' alcool furanico, dell' acido piromucico e dei suoi eteri. Rend. Accad. 3 (1894) 123-129. Beibl. (1894) 666

- Gennari, G.* Spettrochimica del cumarone e delle indene. Rend. Accad. Roma (5) 3 (1894) 499-504; Beibl. (1894) 907.
- Geronzi, B. T.* Misura dell' indice di rifrazione d'un prisma. Riv. sci. 23 (1891) 221-226; Beibl. (1892) 274.
- Ghiru, A.* Rifrazione atomica di alcuni elementi. Rend. Accad. Lincei (5) 2 (1893) 312-319; Beibl. (1893) 1047; Rend. Accad. Roma 3 (1894) 297-301.
- — Potere rifrangente delle combinazioni organo-metalliche. Rend. Accad. Roma 3 (1894) 391-393; Beibl. (1894) 906.
- Giesel, F.* Ueber künstliche Färbung von Krystallen der Haloid-salze durch Einwirkung von Kalium- und Natriumdampf. Ber. chem. Ges. 30 (1897) 156-158; Beibl. (1897) 337.
- — Ueber Radium und Polonium. Phys. Ztsch. 1 (1899) 16-17.
- Gill, D.* Presence of oxygen in the atmospheres of certain fixed stars. Astrophys. J. 10 (1899) 272-282.
- Gill, W. J.* Observations of variable stars in 1895. Astron. J. 16 (1896) 63.
- — Observations of variable stars in 1896. Astron. J. 17 (1897) 94-95.
- Gilpin, J. E.* The preparation of Argon. Sci. n. s. 1 (1895) 582.
- Gladstone, J. H.* Equivalent of Dispersion. Chem. News 55 (1887) 300; Jahresb. (1887) 339.
- — and *W. H. Perkin.* On the correspondence between the Molecular Refraction, Dispersion and Magnetic Rotation of Carbon Compounds. Rept. Brit. Assoc. (1889) 515.
- — and *Gladstone, G.* The refraction and dispersion of Fluor-benzene and allied compounds. Rept. Brit. Assoc. (1890) 772.
- — The molecular refraction and dispersion of various substances. J. Chem. Soc. 59-60 (1891) 290-301; Beibl. (1891) 552-555.
- — and *W. Hibbert.* Some experiments on the molecular refraction of dissolved electrolytes. Rept. Brit. Assoc. (1891) 609; Beibl. (1892) 605.
- — Molecular refraction and dispersion of various substances in solution. J. Chem. Soc. 59 (1891) 589-598; Beibl. (1891) 764.
- — Note on the molecular refraction of metallic carbonyls, Indium, Gallium, and Sulphur. Rept. Brit. Assoc. (1892) 679.
- — Notes on some recent determinations of molecular refraction and dispersion. Phil. Mag. (5) 35 (1893) 204-210.
- — Argon. Nature 51 (1895) 389-390.

- Gladstone, J. H. (Cont'd), and W. Hibbert.* The molecular refraction of dissolved salts and acids. *J. Chem. Soc.* 67 68 (1895) 831-868, 71 (1897) 822-833, *Beibl.* (1896) 195; (1897) 906
- . On specific refraction and the Periodic Law, with reference to Argon and other elements. *Rept. Brit. Assoc.* (1895) 609-610.
- . The relation between the refraction of the elements and their chemical equivalents. *Proc. Roy. Soc.* 60 (1896) 140; *Beibl.* (1897) 26.
- and *W. Hibbert.* Further experiments on the absorption of Röntgen Rays by chemical compounds. *Chem. News* 78 (1898) 199-300.
- Glan, P.* Theoretische Untersuchungen über Licht. *Ann. Phys. n. F.* 58 (1896) 151-153.
- . Zur absoluten Phasenänderung des Lichtes durch Reflexion. *Ann. Phys. n. F.* 47 (1892) 252.
- Glasenapp, S.* Observations de variation d'éclat de l'étoile variable  $\beta$  Lyrae. (In Russian.) *Compt. rend. Soc. astron. Russe* 1 (1896) 153-178.
- Glazebrook, R. T.* A mechanical analogue of anomalous dispersion. *Rept. Brit. Assoc.* (1893) 688-689.
- Gledhill, J.* Observations of the phenomena of Jupiter's satellites and of the transits of the red spots, dark and bright spots, etc., during the Winter of 1894-1895. *Mon. Not.* 55 (1895) 391-398
- . Measures of the polar diameter and of the principal belts, and of two dark spots on Jupiter, and of the satellites and their shadows in transit, 1895-1896. *Mon. Not.* 56 (1896) 476-494.
- . Certain phenomena presented by Jupiter's satellites, etc. *Mon. Not.* 56 (1896) 494-500.
- Gleichen, A.* Ueber die Brechung des Lichts durch Prismen. *Ztsch. Math. u. Phys.* 34 (1889) 161-176; *Beibl.* (1890) 34.
- Gloser, M.* Funkenspektra mittels der Influenzmaschine. *Ztsch. phys. u. chem. Unterr.* 6 (1893) 303-304; *Beibl.* (1894) 559.
- Godard, L.* Proportionalitätsfactoren in der strahlenden Wärme. *C.-R.* 106 (1888) 545-547; *Beibl.* (1888) 344.
- Godfrey, C.* Note on Prof. Wilsing's article on the effect of pressure on wave-length. *Astrophys. J.* 8 (1898) 114.
- Goldhammer, D.* Theorie der Lichtbrechung und Dispersion in Kristallen. *J. russ. phys. chem. Ges.* 18 (1886) 239-267.
- . Ein Versuch zur Theorie der Dispersion und Absorption. *J. russ. phys. chem. Ges.* 24 (1892) 17-39.



- Goldhammer, D.* Das Zeeman'sche Phänomen, die magnetische Circular-polarisation und die magnetische Doppelbrechung. Ann. Phys. n. F. 67 (1899) 696-701.
- Goldstein, E.* Emissionsspectra erster Ordnung bei den Haloiden. Verh. d. phys. Ges. Berlin (1886) 38-41; Beibl. (1890) 616.
- Gooch, F. A., and T. S. Hart.* The detection and determination of potassium spectroscopically. Amer. J. Sci. (3) 42 (1891) 448-459; Beibl. (1892) 278.
- — — and *Phinney, J. J.* The quantitative determination of rubidium by the spectroscope. Amer. J. Sci. (3) 44 (1892) 392-400; Beibl. (1893) 206.
- Gore, J. E.* Die Dichte des Algol. Observatory (1886) 257-258; Beibl. (1887) 67.
- — —. The spectra of stars with large proper motion. Astron. and Astrophys. (1892) 11-12.
- Gorts, A.* Spectrophotometrische Affinitätsbestimmungen. Diss. Tübingen, 1892; Beibl. (1893) 378.
- Gothard, E. von.* Beobachtungen des grossen September Cometen, 1882, zu Hereng, Ungarn. Astron. Nachr. 103 (1882) 377-380; Beibl. (1883) 116.
- — —. Erfahrungen auf dem Gebiete der Himmels und Spectral-Photographie. Jahrb. f. Photogr. (1888) 6 pp.; Beibl. (1888) 250.
- — —. Das Spectrum des neuen Sternes in Auriga im Vergleich mit demjenigen einiger planetarischer Nebel. Ber. aus Ungarn 10 (1892) 246-249; Beibl. (1894) 101.
- — —. Studien über das photographische Spectrum der planetarischen Nebel und des neuen Sterns. Mem. Spettr. Ital. 21 (1892) 1-5; Beibl. (1893) 754.
- — —. Die Vortheile der Photographie bei Spectralstudien lichtschwacher Himmelskörper. Jahrb. f. Photogr. (1893) 102-103; Beibl. (1893) 1067.
- Gouy.* Sur la vitesse de la lumière dans le sulfure de carbone. C.-R. 103 (1886) 244; Jahresb. (1886) 288.
- — —. Recherches expérimentales sur la diffraction. Ann. chim. phys. (6) 8 (1886) 145-192; Jahresb. (1896) 300.
- — —. Recherches théoriques et expérimentales sur la vitesse de la lumière; 1<sup>re</sup> partie, direction constante. Ann. chim. phys. (6) 16 (1889) 262-289.
- — —. Sur l'élargissement des raies spectrales des métaux. C.-R. 108 (1889) 1236-1238; Beibl. (1889) 677.

- Gouy (Cont'd).* Sur une propriété nouvelle des ondes lumineuses. C.-R. 110 (1890) 1251-1253; Beibl. (1890) 969
- , Sur la propagation anormale des ondes. C.-R. 111 (1890) 33-35
- , Vision des objets opaques au moyen de la lumière diffractée. C.-R. 117 (1893) 626-628; Beibl. (1894) 570.
- , De la régularité du mouvement lumineux. C.-R. 120 (1895) 915-917
- , Nouvelle méthode pour produire les interférences à grande différence à marche. C.-R. 120 (1895) 1039-1041; Beibl. (1896) 277
- , Sur les tubes de Natterer. C.-R. 121 (1895) 201-202
- , Réfraction des rayons X. C.-R. 122 (1896) 1197-1198
- , Réfraction et diffraction des rayons X. C.-R. 123 (1896) 43-44.
- , Réflexion de la lumière par une surface longue et étroite. C.-R. 124 (1897) 1146-1147
- Govi, G.* Ueber die unsichtbaren oder latenten Farben der Körper. Rend. Accad. Lincei 4 (1888) 572-577; Beibl. (1889) 502.
- Græbe, C.* Azofarbenspectra. Ztsch. phys. Chem. 10 (1892) 673-698; Beibl. (1893) 336
- Græbe, H.* Untersuchung des Absorptionsvermögens des Blutpigments für violette und ultraviolette Strahlen. Diss. Dorpat 1892; Beibl. (1896) 127.
- Gramont, A. de* Les spectres d'étincelle de quelques minéraux (sulfures métalliques). C.-R. 118 (1894) 591-594, 746-749; Beibl. (1894) 838.
- , Le spectre des lignes du soufre, et sur sa recherche dans les composés métalliques. C.-R. 119 (1894) 68-70; Beibl. (1894) 912.
- , L'analyse spectrale directe des composés solides et plus spécialement des métaux. Bull. Soc. chim. Paris (3) 13 (1894) 945-967
- , Les spectres du sélénium et des quelques séléniures. C.-R. 120 (1895) 778-781; Beibl. (1895) 566.
- , Sur l'analyse spectrale directe des minéraux et de quelques composés organiques dans le sulfure de carbone. C.-R. 121 (1895) 121-123; Beibl. (1896) 30.
- , Les spectres des métalloïdes dans les sels fondus. Loufre. C.-R. 122 (1896) 1326-1328; Beibl. (1896) 693
- , Spectres de dissociation des sels fondus. Métaux alcalins. C.-R. 122 (1896) 1411-1413; Beibl. (1896) 693.

- Gramont, A. de.* Le spectre du phosphore dan les sels fondus et dans certains produits. C.-R. 122 (1896) 1534-1536; Beibl. (1896) 775.
- Spectres des métalloïdes dans les sels fondus. C. R. 124 (1897) 192-194; 125 (1897) 172-175, 238-240; Beibl. (1897) 973.
- — Analyse spectrale directe des minéraux. Paris: Baudry et Cie., 1897, 207 pp.
- — Observations sur les spectres des corps composés. Bull. Soc. chim. Paris (3) 17-18 (1897); Chem. News 76 (1897) 277.
- — Analyse spectrale des composés non-conducteurs, par les sels fondus. C. R. 126 (1898) 1155-1157, 1234, 1513-1515; Beibl. (1898) 774.
- — Observations sur quelques spectres; aluminium, tellure, sélénium. C. R. 127 (1898) 866-868.
- — Les spectres de dissociation des sels fondus, Carbone. Bull. Soc. chim. Paris (3) 19-20 (1898) No. 13; Chem. News 78 (1898) 270-271.
- — Sur un spectroscopie de laboratoire à dispersion et à échelle réglables. C.-R. 128 (1899) 1564-1568
- Gravelaar, A. W.* Das Minimum der Ablenkung eines Lichtstrahls durch ein homogenes prisma. Ztsch. phys. u. chem. Unterr. 3 (1890) 246-247.
- Gray, P. L.* Die Minimaltemperatur der sichtbaren Strahlung. Phil. Mag. (5) 37 (1894) 549-557; Beibl. (1894) 908.
- Grédilla y Gauna* Étude pétrographique de la pierre météorique tombée à Madrid le 10 février 1896. C.-R. 122 (1896) 1559-1560.
- Greene, F.* On a photographic image of an electric arc lamp, probably due to phosphorescence in the eye. Rept. Brit. Assoc. (1889) 617.
- Greenwich* Spectroscopic and Photographic Results, 1885. Greenwich Observations 1885, xxxii and 104 pp.; Beibl. (1888) 194. (These are continued from year to year.)
- Grimpen, A.* Theorie der durch eine kreisförmige Oeffnung erzeugten Beugungserscheinungen. Kiel 1890, 33 pp., Beibl. (1891) 110
- Grosse, W.* Eine neue Form von Photometern. Ztsch. f. Instr. 7 (1887) 129-144, 8 (1888) 95-102, 129-135; Beibl. (1887) 775; (1888) 784.
- — Messungen der Lichtemission und Lichtabsorption. Ztsch. f. Instrum. 9 (1889) 1-9; Beibl. (1889) 679.
- — Die Lehre von der Interferenz und Polarisation des Lichtes im Unterricht. Beibl. (1891) 356.

- Grosse W. (Cont'd).* Bemerkungen zur Wellenlehre. Ztsch. phys. u. chem. Unterr. 5 (1891) 22-24.
- — Die Länge der Prismen und Spectralbezirke. Ztsch. f. Instrum. 13 (1893) 6-13. Beibl. (1894) 183.
- Grubb, Sir H.* Telescopes for stellar photography. Nature 38 (1890) 441-444.
- — The development of the astronomical telescope. Proc. Roy. Inst. (1894) 18 pp.
- Gruner, P.* Die Werthe der Weber'schen Strahlungsconstanten bei verschiedener Kohlenfaden. Diss. Zurich 1893. Beibl. (1893) 924.
- Grunwald, A.* Mathematische Spectralanalyse des Magnesiums und der Kohle. Monatsh. f. Chem. 5 (1887) 650-712. Sitzb. Wiener Akad. 96 II (1887) 1154-1216. Beibl. (1888) 661-662.
- — Die merkwürdige Beziehungen zwischen dem Spectrum des Wasserdampfes und den Linienspectren des Wasserstoffs und Sauerstoffs, sowie über die chemische Structur der beiden letzteren und ihre Dissociation in der Sonnenatmosphäre. Astron. Nachr. (1887) 201-214; Beibl. (1888) 245-246.
- — Spectralanalyse des Cadmiums. Sitzb. Wiener Akad. 97 II (1888) 967-1045. Beibl. (1889) 309.
- — Spectralanalytischer Nachweis von Spuren eines neuen, der elften Reihe des Mendelejeff'schen Tafel angehörigen Elementes, welches besonders im Tellur und Antimon, ausserdem aber auch im Kupfer vorkommt. Sitzb. Wiener Akad. 98 IIa (1889) 785-817; Beibl. (1890) 278.
- — Dr. H. Kayser und meine mathematische Spectralanalyse. Chemiker Ztg. 14 (1889) 4 pp.
- — Das sogenannte zweite oder zusammengesetzte Wasserstoffspectrum von Dr. B. Hasselberg und die Structur des Wasserstoffs. Monatsh. f. Chem. 11 (1890) 129; 13 (1892) 111-244; Sitzb. Wiener Akad. 101 II (1892) 121-254.
- Grus, G.* Spektroskopische Beobachtungen einiger Sterne. Prag, 1897.
- Guglielmo, G.* Ein Mittel die Dispersion von Prismenspectroskopen erheblich zu steigern. Rend. Accad. Lincei (4) 6 (1890) 195-199; Beibl. (1891) 105.
- Guillaume, Ch. Ed.* Solutions of Alum. Nature 44 (1891) 540-541; Beibl. (1892) 278.
- — L'énergie dans le spectre. Rev. gén. 3 (1892) 12-21; Beibl. (1894) 337.

- Guillaume, Ch. Ed.* Possibilité d'une comparaison directe entre la vitesse de propagation de la lumière et des actions électromagnétiques. Arch. de Geneve 28 (1892) 302-306.
- . Ueber die Bestimmung der Correction für den herausragenden Faden mittels eines Hilfsfernrohrs. Ztsch. f. Instrum. 13 (1893) 155-157.
- . Application du principe de Doppler à l'énergie des radiations. J. de phys. (3) 4 (1895) 24-39.
- . Observations du Soleil à Lyon. C.-R. 119 (1894) 529-532, 1186; 120 (1895) 250, 1250; 121 (1895) 710-712, 1120-1122; 1123 (1896) 482-484, 732-734; 124 (1897) 449-451.
- . Sur l'émission des rayons X. C.-R. 123 (1896) 450-452.
- Gumlich, E.* Optisches Drehvermögen des Quarzes für Natriumlicht. Ztsch. f. Instrum. 16 (1896) 97-115.
- . Herstellung von Arons'schen Bogenlampen mit Amalgamfüllung. Ztsch. Instrum. 17 (1897) 161-165.
- Guntz.* Action de la lumière sur le chlorure d'argent. Bull. Soc. chim. Paris (3) 6 (1891) 140-145; C.-R. 113 (1891) 72-75.
- . Sur une expérience simple montrant la présence de l'argon dans l'azote atmosphérique. C.-R. 120 (1895) 777-778.
- Gutzmann, A.* Ueber den analytischen Ausdruck des Huyghens'schen Princip. Verh. deutsch. Naturf. u. Aerzte (1895) 16.
- Gylden.* Untersuchungen über die Constitution der Atmosphäre und die astronomische Strahlenbrechung in derselben. Mem. Acad. St. Petersb. (7) 10 (1866).

## H

- Haacke, C.* Spektrophotometrische Untersuchungen über die Einwirkung von Salzsäure auf einige Substitutionsproducte des Fuchsin. Diss., Tübingen 1894, 49 pp.
- Habben, Th.* Fluoreszenzspectren hervorgebracht durch das Licht Geissler'scher Röhren. Diss., Marburg 1891; Beibl. (1892) 210.
- Hadden, D. E.* Review of Solar Observations, 1891-1895. Pub. A S Pac. 7 (1895) 299-305; 9 (1897) 77-85.
- . The Grating Spectroscope, for small telescopes. Pop. Astron. 3 (1895) 84-86.
- Haga, H.* Eine Aufstellungsweise des Rowland'schen Concavgitters. Ann. Phys. u. F. 57 (1896) 389-393.
- Hagen, J. G.* Note on U Geminorum. Astron. J. 17 (1897) 127.



- Hagenbach, A.* Ein Versuch die beiden Bestandtheile des Clevel-gases durch Diffusion zu trennen. *Ann. Phys. n. F.* 60 (1896) 124-133.
- Hagenbach, E.* Balmer'sche Formel für die Wasserstofflinie. *Beibl.* (1887) 339, *Verh. d. Naturforsch. Ges. Basel* (1886) 1.
- Hale, G. E.* Photography of the Solar Protuberances. *Technolog. Quar.* 3 (1891) 310-316; *Beibl.* (1891) 516.
- — —. Remarkable disturbance on the Sun. *Astron. and Astrophys.* (1892) 3; *Beibl.* (1893) 126.
- — —. The ultra-violet spectrum of the solar prominences. *Amer. J. Sci.* (3) 42 (1891) 459-467; *Beibl.* (1893) 126.
- — —. Recherches sur l'atmosphère solaire. *C.-R.* 114 (1892) 1406-1407.
- — —. Solar Photography at the Kenwood Observatory. *Astron. and Astrophys.* (1892) 2, 105, 407-417, 603-604, *Beibl.* (1893) 126, 752.
- — —. Some results and conclusions derived from a photographic study of the Sun. *Astron. and Astrophys.* (1892) 811-815, *Beibl.* (1893) 753.
- — —. Les raies H et K dans les spectres des facules solaires. *C.-R.* 116 (1893) 170-173.
- — —. Méthode spectrophotographique pour l'étude de la couronne solaire. *C.-R.* 116 (1893) 865-866, *Beibl.* (1893) 931.
- — —. The Solar Faculae. *Astron. and Astrophys.* 13 (1894) 113-122.
- — —. The Spectroheliograph. *Astron. and Astrophys.* 12 (1893) 241-257.
- — —. Some attempts to photograph the Solar Corona without an eclipse. *Astron. and Astrophys.* 13 (1894) 662-688.
- — —. Spectro-Bolographic Investigations at the Smithsonian Astrophysical Observatory. *Astrophys. J.* 1 (1895) 162-166.—See S. P. Langley, Recent Researches in the Infra-Red Spectrum, *Rept. Brit. Assoc.* (1894).
- — —. New method of mapping the solar corona without an eclipse. *Astrophys. J.* 1 (1895) 318-334; *Beibl.* (1896) 32.
- — —. A large eruptive prominence. *Astrophys. J.* 1 (1895) 433-434.
- — —. A photographic method of determining the visibility of interference fringes in spectroscopic measurements. *Astrophys. J.* 1 (1895) 435-438.—See A. A. Michelson, Visibility Curve, *Phil. Mag.*, April 1891; *Smithsonian Contrib.* 842.

- Hale, G. E.* Presence of Helium in Cleveite. *Astrophys. J.* 2 (1895) 76
- — —. On the wave-length of the  $D_3$  line in the spectrum of the Chromosphere. *Astrophys. J.* (1895) 384-385, Beibl. (1896) 199.
- — — and *F. L. O. Wadsworth*. The Objective Spectroscope. *Astrophys. J.* (1896) 54-79.
- — —. Publications of the Lick Observatory, Vol. III (1895).
- — —. Application of Messrs. Jewell, Humphreys, and Mohler's results to certain problems of astrophysics. *Astrophys. J.* 3 (1896) 156-161.
- — —. Effect of a total eclipse of the Sun on the visibility of the solar prominences. *Astrophys. J.* 3 (1896) 374-387.
- — —. Comparative value of refracting and reflecting telescopes for astrophysical investigations. *Astrophys. J.* 5 (1897) 119-131.
- — —. Note on a form of spectrohelograph suggested by Mr. H. F. Newall. *Astrophys. J.* 5 (1897) 211.
- — —. Relative frequency of the H and K lines in the spectrum of the chromosphere. *Astrophys. J.* 6 (1897) 157. See Huggins, *ib.* 77.
- — —. Presence of carbon in the chromosphere. *Astrophys. J.* 6 (1897) 412.
- — —. Spectrum of Saturn's Rings. *Astrophys. J.* 9 (1899) 185.
- — —. Spectra of stars of Secchi's Fourth Type. Plates Yerkes Observ. Bull. No. 7 (1899), *Astrophys. J.* 9 (1899) 271-272.
- — —. Comparison of stellar spectra of the Third and Fourth Types. Plates. *Astrophys. J.* 9 (1899) 273.
- Hall, Mervell*. Spectrum of the Zodiacal Light. *Observ.* (1890) 77-79; Beibl. (1890) 377.
- — —. The Sidereal System, revised in 1896. *Mon. Not.* 57 (1897) 357-378.
- Haller, L.*, et *P. Th. Muller*. Sur les réfractions moléculaires, la dispersion moléculaire et la pouvoir rotatoire spécifique des combinaisons du camphre. *C.-R.* 128 (1899) 1370-1373.
- Hallack, W.* The photography of manometric flames. *Proc. Roy. Soc.* (1894) 112-114, *Phys. Rev.* 2 (1895) 305-307.
- — —. Bolometric investigations in the infra-red spectrum of the Sun. *Sci.* 2 (1895) 174-178.
- Hallwachs, W.* Zusammenhang des Electricitätsverlustes durch Beleuchtung mit der Lichtabsorption. *Gött. Nachr.* (1889) 99 pp.
- — —. Lichtgeschwindigkeit in verdünnten Lösungen. *Gott. Nachr.* (1892) 302-309.

- Hallwachs, W.* (Cont'd). Differentialmethode mit streifender Incidenz zur Bestimmung der Unterschiede der Lichtbrechungsverhältnisse von Flüssigkeiten. *Ann. Phys. n. F.* 50 (1893) 577.
- —. Lichtbrechung und Dichte verdünnter Lösungen. *Ann. Phys. n. F.* 53 (1894) 1.
- —. Differentialspektrometer. *Verh. deutsch. Naturf. u. Aerzte* (1897) 54. See *Ann. Phys. n. F.* 50 (1893) 577.
- —. Doppeltrogrefraktometer. *Ann. Phys. n. F.* 68 (1899) 1-45.
- Hamburger, F.* Farbenwechsel verdünnter Lösungen von chromoxalsäurem Kali. *Ann. Phys. n. F.* 56 (1895) 173-174.
- Hamy, M.* Nouvelle lampe à cadmium pour la production des franges d'interférence à grande différence de marche. *C. R.* 124 (1897) 749-752.
- —. Un appareil permettant de séparer des radiations simples très voisines. *C.-R.* 125 (1897) 1092-1094.
- —. Spectra du cadmium dans un tube à vide. *C.-R.* 126 (1898) 231-234; *Beibl.* (1898) 153.
- —. Application des franges d'interférence, à grandes différences de marche, à l'étude des micromètres. *C.-R.* 126 (1898) 1772-1775.
- —. Détermination des points de repère dans le spectre. *C.-R.* 128 (1899) 1380-1384.
- Hundl, A.* Farbensinn der Thiere und die Vertheilung der Energie im Spektrum. *Sitzb. Wiener Akad.* 94 II (1886) 935-946.
- Hanke, A.* Die Refraktionsäquivalente der Elemente. *Wiener Anzeiger* (1896) 176.
- Hänsch.* Optische Bank nach Paalzow. *Verh. deutsch. Naturf. u. Aerzte* (1887) 235.
- —. Neues Photometer. *Verh. deutsch. Naturf. u. Aerzte* 65 (1893) 23.
- Hansen, Ad.* Die Farbstoffe des Chlorophylls. *Beibl.* (1890) 901.
- Harcourt, Sir A. Vernon, and F. W. Humphrey.* Relation between the composition of a double salt and the composition and temperature of the solution in which it is formed. *Rept. Brit. Assoc.* (1891) 609.
- — —. A ten-candle lamp for use in photometry. *Rept. Brit. Assoc.* (1895) 582; *Beibl.* (1896) 26.
- Hargreaves, R.* Distribution of solar radiation and its dependence on astronomical elements. *Proc. Phil. Soc. Cambridge* 9 (1896) 69-72.
- Harrer, Henry.* Results of an examination of spectrograms of  $\alpha$  Orionis. *Astrophys. J.* 10 (1899) 290.



- Harris, D. F.* Some contributions to the spectrum of Hæmoglobin and its derivatives. *Proc. Roy. Soc. Edinb.* 22 (1898) 187-208; *Beibl.* (1899) 252.
- Hartung, H.* Ein astrophotographisches Objectiv mit beträchtlich vermindertem sekundärem Spektrum. *Ztsch. f. Instrum.* 19 (1899) 269-272.
- Hartinger, L.* Emissionsspectra des Neodym- und Praseodymoxydes und über neodymhaltende Leuchtsteine. *Monatsh. f. Chem.* 12 (1891) 362-367; *Beibl.* (1892) 150.
- Hartl.* Zusammenhang zwischen der terrestrischen Strahlenbrechung und den meteorologischen Elementen. *Medicin. Ztsch.* 16 (1881).
- . Mittlere Refraktionscoefficienten. *Mittheil. d. k. k. militärgeogr. Inst.* Bd. 4 (1884).
- . Neue physikalische Apparate. *Ztsch. phys. chem. Unterr.* 9 (1896) 113-117; *Beibl.* (1896) 973.
- Hartley, W. N.* The ultra-violet spark spectra emitted by metallic elements and their combinations under varying conditions. *Rept. Brit. Assoc.* (1885) 276-284; *Beibl.* (1888) 194.
- . The Spectra of Erbium. *Chem. News* 53 (1886) 179. See *Chem. News* 53 (1886) 154; and W. G. Lettsom, *J. Chem. Soc.* 4 (1882) 210.
- . Spectroscopic Notes on the Carbohydrates and Albuminoids from Grain. *J. Chem. Soc.* 51 (1887) 58-61; *Beibl.* (1887) 437.
- . Relation between the Molecular Structure of Carbon Compounds and their Absorption Spectra. *J. Chem. Soc.* 51 (1887, 152-200, 53 (1888) 641-663; *Beibl.* (1887) 537; (1888) 791.
- . Limit of the solar spectrum, the blue of the sky, and the fluorescence of ozone. *Nature* 38 (1888) 474-477; *Beibl.* (1889) 509.
- . The films produced by vaporized metals and their applications to chemical analysis. *Proc. Roy. Soc.* 46 (1889) 88-90.
- . Constitution of electric sparks. *Proc. Roy. Soc. Dublin* 6 (1890) 363-374.
- . Relations between the lines of various spectra. *Phil. Mag.* (5) 31 (1891) 359-363; *Beibl.* (1891) 514.
- . The spectra of blue and yellow chlorophyll, with some observations on leaf-green. *J. Chem. Soc.* 59-60 (1891) 106-124; *Beibl.* (1891) 280.

- Hartley, W. N. (Cont'd)* The physical character of the lines in the spark spectra of the elements. *Proc. Roy. Soc.* 40 (1891) 448-451; *Beibl.* (1891) 714; *Astron. and Astrophys.* (1892) 223-228.
- — — Liquid prisms. *Nature* 44 (1891) 273; *Beibl.* (1891) 770.
- — — Methods of observing the spectra of easily volatile metals and their salts and of separating their spectra from those of the alkaline earths. *J. Chem. Soc.* Dec. 1, 1892. *Chem. News* 66 (1892) 311-314; *Beibl.* (1893) 925.
- — — Variations observed in the spectra of carbon electrodes, and on the influence of one substance upon the spectrum of another. *Proc. Roy. Soc.* 54 (1892) 344-349; 55 (1895); *Beibl.* (1894) 1046.
- — — Flame Spectra at High Temperatures. Part I. Oxhydrogen Blowpipe Spectra. Part II. The Spectrum of Metallic Manganese, of Alloys of Manganese, and of Compounds containing that Element. Part III. The Spectroscopic Phenomena and Thermo-Chemistry of the Bessemer Process. *Phil. Trans.* 185 (1895) 161-213, 1029-1041, 1041-1093; *Proc. Roy. Soc.* 52 (1892-1893) 5-7, 56 (1894) 192-193, 193-199; *Beibl.* (1893) 1055.
- — — Origin of Colour and Fluorescence. *J. Chem. Soc.* 63 (1893) 243-256; *Beibl.* (1894) 341.
- — — New methods of spectrum analysis, and on Bessemer flame spectra. *Rept. Brit. Assoc.* (1894) 610-611; *Beibl.* (1896) 26.
- — — The spark spectrum of Argon, as it appears in the spark spectrum of Air. *Proc. Roy. Soc.* 57 (1895) 293-296; *Beibl.* (1895) 635.
- — — Remarks on the origin of the lines and bands observed in the spectra of Swedish Bessemer works. *Proc. Roy. Soc.* 59 (1896) 98-101; *Beibl.* (1896) 367.
- — — and *H. Ramage*. The occurrence of the element Gallium in the Clay-Ironstone of the Cleveland District of Yorkshire. *Proc. Roy. Soc.* 60 (1896) 35-37.
- — — On the spectrum of Cyanogen as produced and modified by spark discharges. *Proc. Roy. Soc.* 60 (1896) 216-221.
- — — and *H. Ramage*. The spectrographic analysis of minerals and meteorites. *Chem. News* 76 (1897) 231; *Beibl.* (1898) 667, 774.
- — — A determination of the wave-lengths of principal lines in the spectrum of Gallium, showing their identity with two lines in the solar spectrum. *Proc. Roy. Soc.* 60 (1897) 35 and 393; *Astrophys. J.* 9 (1899) 214-220.

- Hartley, W. N., and H. Ramage.* Spectroscopic analysis of some commercial samples of metals, of chemical preparations and of minerals from Stassfurth Potash Beds. *Proc. Roy. Soc.* 60 (1896) 393; *Proc. Chem. Soc.* Feb. 18, 1897; *Chem. News* 75 (1897) 151. Abs.
- , —. Spectroscopic analysis of blast-furnace iron, cinder, etc. *Proc. Roy. Soc.* 60 (1897) 393-407.
- , —. Experiments on the flame spectrum of carbon monoxide. *Proc. Roy. Soc.* 61 (1897) 217-219.
- , —. Spectrographic analysis of some commercial samples of metals, of chemical preparations and minerals from the Potash Beds. *Chem. News* 77 (1898) 121-122.
- , —. Spectrum Analysis of Meteorites. *Proc. Dublin Soc.* 8 IV. (1898) 68; *Nature* 57 (1898) 546; *Beibl.* (1898) 667.
- , —. Spectrographic analysis of iron meteorites, siderolites, and meteoric stones. *Proc. Roy. Soc.* 8 (1898) 703-710.
- — — and *J. Dobbie.* The ultra-violet absorption spectra of some closed chain carbon compounds. *J. Chem. Soc.* 73 (1898) 598-606; *Beibl.* (1898) 668.
- , —. A study of the absorption spectra of Isatin, Carbostril, and their Alkyl derivatives in relation to Tautomerism. *J. Chem. Soc.* 74 (1899) 640-661.
- — — and *H. Ramage.* Spectroscopic Analysis of Meteors. *Trans. Lond. Chem. Soc.* 51 (1899) 533; *Beibl.* (1899) 789; *Astrophys. J.* 9 (1899) 221-228. (Rubid., Gall., Ind., Ti, Va, Di, Ur, Yt, Os.)
- — —. Absorption spectrum and constitution attributed to Cyanuric Acid. *Proc. Chem. Soc.* March 3, 1899; *Chem. News* 79 (1899) 101.
- Hartman, L. W.* The photometric study of mixtures of Acetylene. *Phys. Rev.* 9 (1899) 176-189.
- Hartmann, J.* Eine photographische Aufnahme des Cometen 1896 III. *Astron. Nachr.* 141 (1896) 253.
- —. Eine einfache Interpolationsformel für das prismatische Spectrum. *Pub. Observ. Potsdam*, 1898, 25 pp.; *Beibl.* (1899) 175.
- —. Die Skale des Kirchhoff'schen Sonnenspektrums. *Sitzb. Berliner Akad.* 46 (1898) 742-756; *Beibl.* (1899) 180; *Astroph. J.* 9 (1899) 69-85.
- —. The relative brightness of the planets Mars and Jupiter, from measurements with a new photometer. *Astrophys. J.* 10 (1899) 225-240.

- Hartmann, J. (Cont'd).* Apparat und Methode zur photographischen Messung von Flächenhelligkeiten. Ztsch. f. Instrum. 19 (1899) 97-104.
- Hartung, E.* Beobachtung eines dunklen Flecks auf Jupiter. Astron. Nachr. 140 (1896) 167.
- Harzer, P.* Ueber Sternphotographien. Astron. Nachr. 130 (1892) 113-120; Beibl. (1894) 98.
- Haschek, A.* Messungen von Brechungsexponenten trüber Medien. Sitzb. Wiener Akad. 97 II a (1888) 958; Jahresb. (1888) 423.
- Haschek, E.* Die ultravioletten Funkenspektren der Elemente. Wiener Anzeiger (1896) 75.
- — und *H. Mache.* Ueber den Druck im Funken. Sitzb. Wiener Akad. 107 II (1898) 1253-1265.
- Hasselberg, B.* Nachtheile von Schwefelkohlenstoffprismen. Ann. Phys. n. F. 27 (1886) 415; Jahresb. (1886) 302.
- —. Das Bandenspectrum des Stickstoffs und seine Ursprung. Mem. Spettr. Ital. 15 (1886) 1-3; Beibl. (1888) 349.
- —. Eine Methode die Brennweite eines Linsensystems für verschiedene Strahlen mit grosser Genauigkeit zu bestimmen. Bull. Akad. St. Petersb. Mélanges math. et astron. 6 (1888) 670-699.
- —. Untersuchungen über das Absorptionsspectrum des Iodgases. Mem. Acad. St. Petersb. (7) 36 (1889) 50 pp.; Jahresb. (1889) 318.
- —. Zur Spectroscopie der Verbindungen. K. Svensk. Akad. Handl. 24 (1892) 45 pp.; Beibl. (1892) 738-739.
- —. Vorschlag einer Methode, um mit grosser Genauigkeit den Brechungsindex und die Dispersion der Luft zu bestimmen. Oefver. Vet. Akad. Forh. Stockholm 49 (1892) 441-449; Beibl. (1893) 915.
- —. Notiz über die Spectroskopie des Schwefels. Beibl. (1894) 86; Astron. and Astrophys. 12 (1893) 347-349.
- —. Das Absorptionsspectrum des Broms. K. Svensk. Akad. Forh. 24 (1893) 53 pp.; Beibl. (1894) 339.
- —. Linienspectrum des Sauerstoffs. Ann. Phys. n. F. 52 (1894) 758; Astron. and Astrophys. 13 (1894) 760-763.
- —. Die Spektren der Metalle im elektrischen Flammenbogen. Spectrum des Chroms. K. Svensk. Akad. Handl. 26 (1894) No. 5, 33 pp.; Beibl. (1894) 837.
- —. Sur les observations spectroscopiques des nébuleuses faites à Mt. Hamilton. Mem. Spettr. Ital. 24 (1895) 1-11.
- —. Die Spektren der Metalle im elektrischen Flammenbogen. Spectrum des Titans. K. Svensk. Akad. Handl. 28 (1896) 32 pp.; Beibl. (1896) 304; Astrophys. J. (1896) 116-134, 212-233.

- Hasselberg, B.* Die Spektra der Metalle im elektrischen Flammenbogen, Kobalt und Nickel. K. Svensk. Akad. Handl. 28 (1896) 44 pp., 3 Taf.; Beibl. (1896) 692; Astrophys. J. 5 (1897) 38-49.
- . Die Spektra der Metallen im elektrischen Flammenbogen, Spektrum des Mangans. K. Svensk. Vet. Akad. Handl. 30 (1897) 20 pp.; Beibl. (1898) 401.
- . Das Vorkommen des Venads in den skandinavischen Rutilarten. Bih. k. Svensk. Akad. Handl. 22 I (1897) 7 pp.; Beibl. (1897) 227; Astrophys. J. 5 (1897) 194-198; 6 (1897) 22, 157, 369.
- . Die Spektra der Metalle im elektrischen Flammenbogen, Spektrum des Vanads. K. Svensk. Akad. Handl. 32 (1899) 38 pp.; Beibl. (1899) 634; Astrophys. J. 9 (1899) 143-148.
- Hasterlich, A.* Die bisherigen Methoden zum Nachweiss fremder Farbstoffe im Weine. Diss. Erlangen 1889, 86 pp.; Beibl. (1890) 281.
- Hastings, C. S.* New type of telescope objective for spectroscopic use. Astrophys. J. 9 (1899) 162-166; Amer. J. Sci. (4) 7 (1899) 267-271.
- Hauke, A.* Refraktionsäquivalente der Elemente. Wien: Gerold, 1896.
- Hausdorff, F.* Zur Theorie der astronomischen Strahlenbrechung. Ber. Sächs. Ges. Wiss. (1891) 481-566; (1892) 481-566; (1893) 120-162.
- . Absorption des Lichtes in der Atmosphäre. Vierteljahrsschr. d. astron. Ges. 31 (1896) 2-28; Beibl. (1895) 888.
- Haycraft, J. B.* Luminosity and Photometry. Proc. Roy. Soc. 61 (1897) 49.
- Heaviside, O.* Transformation of optical wave-surfaces by homogeneous strain. Proc. Roy. Soc. 54 (1894) 26-30.
- . Dispersion. Electrician 37 (1896) 470-472.
- Hebert, A., und G. Regnaud.* Photometer. Chem. Centralbl. (1898) 1265.
- Hecht, B.* Die Modification, welche die Neigung der Grenze der Totalreflexion bei Benutzung der Wollaston'schen Methode durch den Austritt aus dem Prisma erleidet. N. Jahrb. f. Min. Geol. u. Paleont. 1 (1887) 218-221; 2 (1887) 180-182; Beibl. (1888) 192.
- Heen, P. de.* Vérification expérimentale de notre théorie du tube de Crookes. Bull. Acad. Belg. (3) 32 (1896) 277-279.
- . Photographie de la chromosphère du Soleil, et constitution de cet astre. Bull. Acad. Belg. (3) 33 (1897) 205-210, 800-802.



- Hecn. P. de (Cont'd).* Détermination de la partie du spectre qui développe la plus grande proportion d'infra électricité. *Bull. Acad. Belg.* (3) 33 (1897) 321-323.
- Helmholtz, H. von.* Die Störung der Wahrnehmung kleinster Helligkeitsunterschiede durch das Eigenlicht der Netzhaut. *Ztsch. f. Psychol. u. Physiol.* 1 (1890) 5-17.
- . Kurzeste Linien im Farbensystem. *Sitzb. Berliner Akad.* (1891) 1071-1083.
- . Versuch einer erweiterten Anwendung des Fechner'schen Gesetzes im Farbensystem. *Ztsch. f. Psychol. u. Physiol.* 2 (1891) 30 pp.
- . Versuch das psychophysische Gesetz auf die Farbenunterschiede trichromatischer Augen anzuwenden. *Ztsch. f. Psychol. u. Physiol.* 3 (1891) 20.
- . Elektromagnetische Theorie der Farbenzerstreuung. *Ann. Phys. n. F.* 48 (1893) 389, 723.
- Helmholtz, R. von.* Ein Bolometer. *Beibl.* (1889) 882.
- . Strahlungsenergie von Flammen. *Verh. phys. Ges. Berlin* 8 (1889) 51-54; *Beibl.* (1889) 808.
- . Die Licht- und Wärmestrahlung verbrennender Gase. *Gekrönte Preisarbeit*, Berlin: Simion, 1890; *Beibl.* (1890) 589-602.
- Hemptonne, A. de.* Action des rayons X sur la luminescence des gaz. *Compt. rend.* 125 (1897) 428-431.
- . Sur la luminescence des gaz. *Bull. Acad. Belg.* 37 (1899) 22-43.
- . Influence du magnétisme sur la luminescence des gaz. *Bull. Acad. Belg.* 37 (1899) 447-479.
- Hemsalech, G. A.* Some new lines in the spark spectrum of Aluminum. *Phil. Mag.* (5) 43 (1897) 289-291.
- . Sur les spectres des décharges oscillantes. *C.-R.* 129 (1899) 285-288.
- Henderson, A.* Observations of Jupiter's red-spot. *Jour. B. A. A.* (1895) 154.
- Henocque, A.* Spectroscopie biologique. Spectroscopie du sang. Paris: Masson, 1895, 200 pp. avec fig.
- Henrich, F.* Die von Bunsen aufgestellten Gleichungen, welche die Absorptionsefficienten der Gase zu berechnen gestatten. *Ztsch. phys. Chem.* 6 (1892) 435-444.
- Henry, Ch.* Préparation nouvelle, et photométrie du sulfure de zinc phosphorescent. *C.-R.* 115 (1892) 505-507.
- . Le minimum perceptible de lumière. *C.-R.* 116 (1893) 930.

- Henry, Ch.* Utilité, en radiographie, d'écrans au sulfure de zinc phosphorescent. émission par les vers luisants de rayons traversant le papier aiguillé. C.-R. 122 (1896) 312-314; 123 (1896) 400-401.
- —. Détermination, par une méthode photométrique nouvelle, des lois de la sensibilité lumineuse aux noirs et aux gris. C.-R. 122 (1896) 951-954; Beibl. (1896) 702.
- —. La relation générale qui relie à l'intensité lumineuse les degrés successifs de la sensation, et sur les lois du contraste simultané des lumières et des teintes. C.-R. 122 (1896) 1139-1142; 123 (1896) 452-454.
- — et *G. Segny*. Photométrie du sulfure de zinc phosphorescent excité par les rayons cathodiques dans l'ampoule de Crookes. C.-R. 122 (1896) 1198-1200.
- —. Actino-photomètre. C.-R. 128 (1899) 941-944; Beibl. (1899) 639.
- Henry, J.* Experiments on the effect of ultraviolet light on the conductivity of Iodine vapour. Proc. Cambridge Phil. Soc. 9 (1897) 319-322; Beibl. (1898) 169.
- Henry, P.* Une méthode de mesure de la dispersion atmosphérique. C.-R. 112 (1891) 377-380; Beibl. (1891) 355.
- Heppenger, J. von.* Zur Theorie der astronomischen Refraktion. Sitzb. Wiener Akad. 102 11a (1893) 321-355; Beibl. (1894) 554.
- —. Einfluss der selektiven Absorption auf die Extinction des Lichtes in der Atmosphäre. Sitzb. Wiener Akad. 105 11a (1895) 173-227.
- Herbert-Jackson.* Use of certain phosphorescent substances in rendering X-rays visible. Chem. News 72 (1895) 150.
- Hering, E.* Einfluss der macula lutea auf spectrale Farbgleichungen. Archiv f. d. gesamt. Physiol. 54 (1893) 277-312.
- Hermann, Th. Simon.* Ueber ein neues photographisches Photometrierverfahren und seine Anwendung auf die Photometrie des ultravioletten Spektralgebietes. Ann. Phys. n. F. 59 (1896) 91-115.
- Herschel, A. S.* The use of bisulphide of carbon prisms for cases of extreme spectroscopic dispersion. Rept. Brit. Assoc. (1885) 942-944; Beibl. (1888) 336.
- —. Spectrum of copper-chlorid. Nature 41 (1890) 513-514. Beibl. (1890) 782.
- —. Aurora of November 23, 1894. Nature 51 (1895) 246-247.

- Herschel, A. S. (Contd.)* A relation between the spectrum of hydrogen and acoustics. *Observatory* 19 (1896) 232-234; *Astrophys. J.* 7 (1898) 150.
- — —. The Rydberg-Schuster Law of Elementary Spectra. *Nature* 55 (1897) 271.
- Hertz, H.* Einfluss des ultra-violetten Lichtes auf die electrische Entladung. *Sitzb. Berliner Akad.* (1887) 487-490; *Ann. Phys. n. F.* 31 (1887) 983-1000.
- Herzig, J.* Einwirkung von Iodwasserstoffsäure auf aromatische Bromderivate. *Sitzb. Wiener Akad.* 107 IIb (1898) 111-115.
- Hesekus, N. N.* Ein Photometer mit geneigtem Schirm und drei Flecken. *J. russ. Ges.* 24 (1892) 165-175; *Beibl.* (1893) 649; *J. de phys.* (3) 2 (1893) 504-505.
- Hess, W.* Einige einfache Gesetze, welchen der durch ein Prisma gehende Lichtstrahl gehorcht, und das Minimum der Ablenkung. *Ann. Phys. n. F.* 36 (1889) 264-270.
- Heumann, K., und H. Rey.* Ueber Farbstoffe aus der Gruppe der Benzine. *Ber. chem. Ges.* 22 (1889) 3001-3004.
- Heycock and Neville.* On the superficial colour of a silver-zinc alloy. *Proc. Phil. Soc. Cambridge* 9 (1897) 222-224.
- Hilbert, W.* The Gladstone "Law" in Physical Optics and the True Volume of Liquid Matter. *Phil. Mag.* (5) 39 (1895) 321-345.
- Higgs, G.* New photographs of the less refrangible parts of the solar spectrum under varying atmospheric conditions. *Rept. Brit. Assoc.* (1890) 760; *Beibl.* (1892) 279.
- — —. Geometrical construction of the oxygen absorption lines Great A, Great B, and  $\alpha$  of the Solar Spectrum. *Proc. Roy. Soc.* 54 (1893) 200-209; *Beibl.* (1894) 338.
- — —. The Photographic Normal Solar Spectrum. *Astrophys. J.* 7 (1898) 86-89.
- Hill, E. A.* Argon. Prout's Hypothesis and the Periodic Law. *Amer. J. Sci.* (3) 49 (1895) 359-377, 405-417.
- Hillebrand, F. W.* Ueber Phosphoreszenz von Wollastonit. *Ztsch. f. Kryst. u. Min.* 30 (1898) 393.
- Hills, E. H.* The total solar eclipse of April 16, 1893. Report on results obtained with the slit spectroscopes. *Proc. Roy. Soc.* 56 (1894) 20-36; *Astrophys. J.* 1 (1895) 91-92, Abs.
- — —. Total Solar Eclipses. *Mon. Not.* 56 (1896) 258-260, 282-284.
- Hisgen, J.* Maxima and Minima veränderlicher Sterne. *Astron. Nachr.* 141 (1896) 94-98.



- Hlawatsch, C.* Brechungsexponenten einiger pigmentirter Mineralien. Beibl. (1897) 511.
- Hodgkinson, W. R., and F. K. S. Lowndes.* Action of a platinum wire made incandescent by a current on some gases and vapours. Chem. News 58 (1888) 187, 223-224.
- Hoffler, F.* Untersuchungen über die Existenz der objectiven Aberration. Diss. Zurich, 1895, 49 pp.
- . Methode zur Bestimmung der Geschwindigkeit des Lichtes und des Sonnensystemes im Raum. Verh. deutsch. Naturf. u. Azte (1897) 37-38, 727.
- Hoffmann, L., und G. Kruss.* Die Sulfide des Goldes. Ber. chem. Ges. 20 (1887) 2369-2376.
- Hoffmann, M. W.* Ueber einige Wirkungen des elektrischen Feldes auf eine Glühlampe. Ann. Phys. n. F. 60 (1897) 642-652.
- Holden, E. S.* Observations of dark markings on Venus. Pub. A. Soc. Pac. 8 (1896) 181-183.
- , ——. Beobachtung des Siriusbegleiters. Astron. Nachr. 142 (1896) 13.
- Holetschek, J.* Beobachtungen des Encke'schen Cometen 1895. Astron. Nachr. 137 (1895) 237-238.
- , ——. Beobachtungen von veränderlichen Sternen. Astron. Nachr. 140 (1896) 171-173.
- , ——. Helligkeiten und Schweife verschiedener Cometen. Viert. d. astron. Ges. 31 (1897) 250, 261-265.
- , ——. Bemerkungen und Berichtigungen zur Cometenlehre. Astron. Nachr. 143 (1897) 113-121.
- Homann, H.* Beiträge zur Untersuchung der Sternbewegungen und der Lichtbewegung durch Spectralmessungen. Diss. Berlin (1885) 28 pp.; Beibl. (1887) 146.
- Hoor, M.* Einfluss des ultravioletten Lichtes auf elektrische Ladungen und Entladungen. Repert. d. Phys. 91-119.
- Horn, G.* Beiträge zur Kenntniss der Dispersion des Lichts in absorbirenden Krystallen. Diss. Göttingen 1898, 72 pp.; Beibl. (1899) 183.
- Hough, G. W.* Physical constitution of the planet Jupiter. Astron. and Astrophys. 13 (1894) 89-92.
- , ——. The spots and markings on the planet Jupiter. Astron. Nachr. 140 (1896) 273-283.
- Houston, E. J., und A. E. Kennelly.* Eine einfache Methode näherungsweise die harmonischen Komponenten einer gegebenen Wellenlänge zu bestimmen. Elektrotechn. Ztsch. 19 (1898) 714-716.

- Howe, J. L.* and *S. G. Hammer*. Color of Sulphur Vapor. *J. Amer. Chem. Soc.* 20 (1898) No. 10; Beibl. (1899) 178.
- Howell, E. E.* Two new meteorites. *Amer. J. Sci.* (3) 50 (1895) 252-254.
- Hübl, A., Freiherr von*. Absorptionsband und Farbe der Pigmente. *Jahrb. d. Photogr.* (1897) 56-59.
- Hujner, G.* Ueber ein neues Spectrophotometer. *Ztsch. phys. Chem.* 3 (1889) 562-571; Beibl. (1889) 828.
- . Lehre für die Spectroscopie und Photometrie des Blutes. *Archiv. f. Physiol.* (1890) 1-2, 28-30.
- . Farbe des Wassers. *Arch. f. Physiol.* (1891) 88-102.
- . Neue Versuche zur Bestimmung der Sauerstoffcapacität des Blutfarbstoffes. *Arch. f. Anat. u. Physiol.* (1894) 130-176; Beibl. (1894) 913.
- Huggins, W.* Note on the spectra of erbia and some other earths. *Proc. Roy. Soc.* 18 (1869-70) 546; *Jahresb.* (1870) 174.
- . Spectrum of the Stella Nova visible in the Great Nebula of Andromeda. *Rept. Brit. Assoc.* (1885) 932.
- . On the wave-length of the principal line in the spectrum of the Aurora. *Proc. Roy. Soc.* 45 (1889) 430-436; Beibl. (1889) 507.
- . Limit of solar and stellar light in the ultraviolet part of the spectrum. *Proc. Roy. Soc.* 45 (1889) 544; 46 (1889) 133-135; Beibl. (1889) 884.
- and *Mrs. Huggins*. Note on the photographic spectra of Uranus and Saturn. *Proc. Roy. Soc.* 46 (1889) 231-233; Beibl. (1889) 947.
- . Sur le spectre photographique d'Uranus. *C.-R.* 108 (1889) 1228-1229; Beibl. (1889) 688.
- , and *Mrs. Huggins*. The visible and photographic spectrum of the Great Nebula in Orion. *Proc. Roy. Soc.* 46 (1889) 40-60.
- , ———. A new definition of the principal line in the spectrum of the Nebula of Orion, and on the character of the line. *Proc. Roy. Soc.* 48 (1890) 202-213; Beibl. (1891) 35.
- . Sur le spectre visible et photographique de la grande nébuleuse d'Orion. *C.-R.* 110 (1890) 1310-1311; Beibl. (1890) 790.
- and *Mrs. Huggins*. A new group of lines in the photographic spectrum of Sirius. *Proc. Roy. Soc.* 48 (1890) 213, 216-217; *C.-R.* 110 (1890) 1310, 1357-1358; Beibl. (1891) 790.
- , ———. Wolff's and Rayet's stars with bright lines in the Swan. *Chem. News* 63 (1891) 27-30, 39-40; Beibl. (1891) 209.

- Huggins, W.*, and *Mrs. Huggins* (Cont'd). Preliminary note on Nova Aurigæ. *Proc. Roy. Soc.* 50 (1891) 465.
- — New star in Auriga. *Proc. Roy. Instit.* May 13, 1892, 10 pp.
- — and *Mrs. Huggins*. The new star in the Wagoner. *Proc. Roy. Soc.* 51 (1892) 486-495.
- —. The bright bands in the present spectrum of Nova Aurigæ. *Proc. Roy. Soc.* 54 (1892-1893) 30-36.
- —. Note on the spectrum of the Great Nebula in Orion. *Astron. and Astrophys.* 13 (1894) 568.
- —. Note on the atmospheric bands in the spectrum of Mars. *Astrophys. J.* 1 (1895) 193-195; *Beibl.* (1896) 36.
- —. The modern spectroscope. The Tulse Hill Ultra-Violet Spectroscop. *Astrophys. J.* 1 (1895) 359-365; *Beibl.* (1896) 196.
- —. Ueber die Duplicität der Linie D<sub>3</sub> des Sonnenspectrums. *Astron. Nachr.* 138 (1895) 229-230; *Beibl.* (1896) 199.
- —. The Helium of the Earth and the Sun. *Chem. News* 71 (1895) 283; *Beibl.* (1895) 634.
- —. Helium. *Chem. News* 72 (1895) 26-27.
- — *Sir W.*, and *Lady Huggins*. Effect of Density on the Spectrum of Calcium. *Astrophys. J.* 6 (1896) 322-327.
- —. Carbon in bright-line stars. *Nature* 55 (1897) 316-317.
- —. An automatic arrangement for giving breadth to stellar spectra on a photographic plate. *Astrophys. J.* 5 (1897) 8-10.
- — and *F. W. Very*. The mode of printing maps of spectra and tables of wave-lengths. *Astrophys. J.* 6 (1897) 55-56.
- — *Sir William*, and *Lady Huggins*. The Great Nebula of Orion,  $\beta$  Cygni, etc. *Astrophys. J.* 6 (1897) 322-327.
- —.  $\alpha$  Lyræ. *Astrophys. J.* 6 (1897) 322-327.
- —. The relative behavior of the H and K Lines of the Spectrum of Calcium. *Proc. Roy. Soc.* 61 (1897) 433-441.
- —. Sur les spectres composants colorées des étoiles doubles. *C.-R.* 125 (1897) 512-514.
- —. Sur les spectres des étoiles principales du Trapèze de la Nébuleuse d'Orion. *C.-R.* 125 (1897) 514-515.
- Hull, G. F.* Action of Coherers. *Astrophys. J.* 6 (1897) 141-144.
- —. Use of the interferometer in the study of electric waves. *Phys. Rev.* 5 (1897) 231-247.
- Humphreys, W. F.*, and *J. P. Mohler*. Effect of pressure on the wave-length of lines in the arc-spectra of certain elements. *Astrophys. J.* 3 (1895) 114-118; *Beibl.* (1896) 583.

- Humphreys, W. F. (Cont'd).* A further study of the effect of pressure on the wave-lengths of lines in the arc-spectra of certain elements. *Astrophys. J.* 4 (1896) 242-262.
- — —. Changes in the wave-frequencies of the lines of emission spectra of elements, their dependence upon the elements themselves and the physical conditions under which they are produced. *Astrophys. J.* 6 (1897) 169-232; *Beibl.* (1898) 219; *Rept. Brit. Assoc.* (1897) 556-557.
- — —. Absorption of Röntgen radiation. *Phil. Mag.* (5) 44 (1897) 401-404.
- Humpidge, T. S.* The Spectra of Erbium. *Chem. News* 53 (1886) 154.  
— See Hartley, *Chem. News* 53 (1886) 179; and Lettsom, *J. Chem. Soc.* 41 (1882) 210.
- Hupe, A.* Bolometrische Arbeiten. Die Rotationsdispersion ultrarother Strahlen im Quarz. *Wiss. Beil. Progr. Realschule, Charlottenburg, Ostern 1894*, 46 pp.
- Hurion, A.* Diffraction par un écran circulaire. *J. de phys.* (2) 9 (1890) 55-57.
- — —. Transmission de la lumière à travers les milieux troublés. *C.-R.* 112 (1891) 1431-4; *Beibl.* (1891) 647.
- — —. Sur les franges visibles dans une oculaire nadirale. *J. de phys.* (3) 1 (1892) 414-424; *Beibl.* (1893) 341.
- Hurmuzescu, D.* La nature du métal dans l'absorption et l'émission des rayons X. *Éclairage électr.* 15 (1898) 166-168.
- Husman, A.* Ueber das Doppler'sche Princip. *Ztsch. phys. u. chem. Unterr.* 5 (1896) 237-238.
- Hussel, A.* Eine neue Methode zur Messung der Drehung, welche ultrarother Strahlen von bestimmter Wellenlänge im Quarz erleiden. *Diss. München 1891*, 13 pp.
- Hussey, W. F.* Physical characteristics of Comet Rordame. *Pub. A. Soc. Pac.* 7 (1895) 185-191.
- — —. The Companion of Sirius and its brightness according to photometric theory. *Pub. A. Soc. Pac.* 8 (1896) 183-186.
- — —. Nova Z, Centauri and the Nebula surrounding it. *Pub. A. Soc. Pac.* 8 (1896) 220-222.
- — —. Projection on the Terminator of Mars. *Astron. J.* 16 (1896) 208; *Astron. Nachr.* 141 (1896) 403.
- Hutchins, C. C.* A new photospectroscope. *Amer. J. Sci.* (3) 33 (1887) 58-59; *Beibl.* (1888) 46.
- — — and *E. S. Holden.* Existence of certain elements, together with the discovery of Platinum in the Sun. *Phil. Mag.* (5) 24 (1887) 325-330; *Amer. J. Sci.* (3) 34 (1887) 451-456.

- Hutchins, C. C. (Cont'd).* Notes on metallic spectra. *Amer. J. Sci.* (3) 37 (1889) 474-476.  
 — — —. Radiation of atmospheric air. *Amer. J. Sci.* (3) 43 (1892) 357-365.  
 — — —. Notice on the absorption of radiant heat by Alum. *Amer. J. Sci.* (3) 43 (1892) 558-559; *Beibl.* (1892) 666.  
 — — —. Absorption of gases in a high vacuum. *Am. J. Sci.* (4) 6 (1898) 61-64.  
*Hutton, R. S.* Compound line spectrum of hydrogen. *Phil. Mag.* (5) 46 (1898) 338-343. (With bibliography of recent contributions to the hydrogen spectrum.)

## I

- Imbert, A., et H. Bertin-Sans.* Diffusion des rayons de Röntgen. *C.-R.* 122 (1896) 524-526.  
*Innes, R. T. A.* Order of brightness of first magnitude stars. *Jour. B. A. A.* 5 (1895) 402-405.  
 — — —. Magnitude of  $\eta$  Argus, 1896. *Mon. Not.* 57 (1897) 155.  
*Iruin, W.* Cause of the light of the hydrocarbon flame. *J. Chem. India* 16 (1897) 296-297; *Beibl.* (1897) 862.  
*Isaachsen, D.* Farbenänderungen von Salzlösungen. *Ztsch. phys. Chem.* 8 (1891) 145-149.  
*Isambert, F.* Action de l'acide chlorhydrique gazeux sur le fer. *C.-R.* 102 (1886) 423-425.  
*Ives, F. E.* Aether-Oxygenlaterne. *Dingler's pol. J.* 276 (1890) 322.  
 — — —. The Photochromoscope. *Trans. Scottish Soc. Arts* (1896) 136-151.  
*Izarn.* Photographie de certains phénomènes fournis par des combinaisons de réseaux. *C.-R.* 116 (1893) 572-574; *Beibl.* (1893) 1071.  
 — — —. Photographie des ondes stationnaires lumineuses. *C.-R.* 121 (1895) 884-886; *Beibl.* (1896) 653.

## J

- Jackson, Herbert.* Use of certain phosphorescent substances in rendering X-rays visible. *Chem. News* 72 (1895) 150; *J. Chem. Soc.* 55-56 (1894) 743-744; *Beibl.* (1894) 1049.  
 — — —. Phosphorescence. *Phil. Mag.* (5) 46 (1898) 402-414; *Beibl.* (1898) 847

- Jacoby, H.* The errors of réseaux. *Observ.* 19 (1896) 205-206.
- Jadanza.* Un prisma universale a riflessione. *Atti Accad. Torino* 26 (1890-1891) 459-466; *Beibl.* (1892) 200.
- Jäger, G.* Folgerungen aus den Eigenbewegungen der Fixsterne. *Monatsh. f. Math. u. Phys.* (1891) 1-22; *Beibl.* (1891) 419; (1892) 363.
- —. Longueur de chemin. *Arch. de Genève* (3) 34 (1895) 376-377.
- Jahn, H., und G. Moller.* Die Dispersionsfreie Molecularrefraction einiger organischer Verbindungen. *Ztsch. phys. Chem.* 13 (1894) 385-397; *Beibl.* (1894) 831.
- Janet, P.* Formules de Fresnel relatives à la réflexion totale. *J. de phys.* (3) 1 (1892) 373-375.
- Janssen, J.* Notes sur les travaux récents exécutés à l'observatoire de Meudon. *C.-R.* 105 (1887) 325-328.
- —. Sur les spectres de l'oxygène. *C.-R.* 106 (1888) 1118-1119; *Beibl.* (1888) 527.
- —. Le spectre tellurique dans les hautes stations, et en particulier sur le spectre de l'oxygène. *C.-R.* 107 (1888) 672-677; *Beibl.* (1889) 383, 682.
- —. L'application de l'analyse spectrale à la mécanique moléculaire et sur les spectres de l'oxygène. *Rept. Brit. Assoc.* (1889) 547-554; *Beibl.* (1890) 617-618.
- —. L'éclipse partielle de Soleil du 17 juin. *C.-R.* 110 (1890) 1353-1355.
- —. Compte rendu d'une ascension scientifique au Mont Blanc. *C.-R.* 111 (1890) 431-447; *Beibl.* (1891) 35.
- —. La méthode spectrophotographique qui permet d'obtenir la photographie de la chromosphère, des facules etc. *C.-R.* 116 (1893) 456-458; *Beibl.* (1893) 931.
- —. Note sur l'histoire des faits qui ont démontré l'existence de l'atmosphère coronale du soleil. *C.-R.* 117 (1893) 77-80; *Beibl.* (1894) 94.
- —. Les spectres de l'oxygène porté aux températures élevées. *C.-R.* 118 (1894) 754-760, 1007-1009; *Nature* 50 (1894) 249-250; *Beibl.* (1894) 751, 837.
- —. La loi d'absorption des bandes du spectre d'oxygène. *C.-R.* 120 (1895) 1306-1310; *Beibl.* (1896) 534.
- —. La présence de la vapeur d'eau dans l'atmosphère de la planète Mars. *C.-R.* 121 (1895) 233-237; *Beibl.* (1896) 36.
- —. Les travaux exécutés en 1896 à l'observatoire du Mont Blanc. *C.-R.* 123 (1896) 585-587.



- Fanssen, F. (Cont'd.)* Lava peur d'eau dans l'univers Bull. Soc. astron France (1896) 226-227.
- Faumann, G.* Eine Methode zur Bestimmung der Lichtgeschwindigkeit. Sitzb. Wiener Akad. 100 II (1891) 1239-1243.
- , Zur Kenntniss des Ablaufs der Lichtemission. Ann. Phys. n. F. 53 (1894) 832-840; Astrophys. J. 2 (1895) 215-223.
- , Ueber Lichtemission. Ann. Phys. n. F. 2 (1895) 241-242.
- , Longitudinales Licht. Ann. Phys. n. F. 57 (1896) 147-184.
- , Interferenz und die elektrostatische Ablenkung der Kathodenstrahlen. Sitzb. Wiener Akad. 106 II (1897) 533-550; Ann. Phys. n. F. 64 (1898) 262-278.
- , Interferenz der Kathodenstrahlen. Ann. Phys. 67 (1899) 741-780.
- Fesse, O.* Leuchtende Wolken. Beibl. (1891) 355.
- , Die Höhe der leuchtenden Nachtwolken. Astron. Nachr. 140 (1896) 161-167; Beibl. (1896) 697.
- Fewell, L. E.* The absolute scale of intensity for the lines of the solar spectrum and for quantitative analysis. Astron. and Astrophys. 12 (1893) 815-821; Beibl. (1894) 670.
- , The object-glass grating. Astrophys. J. 13 (1893) 44-48.
- , Spectrum of Mars. Astrophys. J. 1 (1895) 311-317; 3 (1896) 255-250; Beibl. (1896) 36.
- , The coincidence of solar and metallic lines. Astrophys. J. 3 (1896) 89-113; 4 (1896) 138.
- , *F. F. Mohler, and W. F. Humphreys.* Note on the pressure of the "reversing layer" of the solar atmosphere. Astrophys. J. 3 (1896) 138-140; Beibl. (1896) 537.
- , The Spectrum of Mars. Astrophys. J. 3 (1896) 255-258.
- , The determination of the relative quantities of aqueous vapor in the atmosphere by means of the absorption lines of the spectrum. Astrophys. J. 4 (1896) 324-342.
- , Oxygen in the Sun. Astrophys. J. 5 (1897) 99-100.
- , Dr. Arendt's spectroscopic investigation of the variation of aqueous vapor in the atmosphere. Astrophys. J. 5 (1897) 279-281.
- , The structure of the shading of the "H" and "K" and some other lines in the spectrum of the Sun and arc. Johns Hopkins Univ. Cir. 17 (1898) 62-63; Astrophys. J. 8 (1898) 51-53.
- , A chromospheric line near K. Astrophys. J. 8 (1898) 119-120.

- Jewell, L. E. (Cont'd)* The wave-length of  $H\delta$  and the appearance of the solar spectrum near the hydrogen lines. *Astrophys. J.* 9 (1899) 211-214; *Beibl.* (1899) 780.
- — —. Notes on the papers of Hartley and Ramage concerning the spectrum of Gallium and the spectra of meteorites. *Asphys. J.* 9 (1899) 229-230; *Beibl.* (1899) 789.
- Johnson, A.* Newton's use of the slit and lens for the production of a pure spectrum. *Trans. Roy. Soc. Canada* 9 (1893) 45-54; *Beibl.* (1893) 825.
- Johnstone, J. G.* On atmospheres upon planets and satellites. *Dublin Trans.* 6 (1897) 305-328.
- Jones, A. C.* Einige Emissionsspektren des Cadmiums, Zinks und der Haloidverbindungen des Quecksilbers und einiger anderen Metallen. *Ann. Phys. n. F.* 62 (1897) 30-53. Diss. Erlangen, 1897.
- Joubin, P.* Les franges d'interférence de deux trous. *J. de phys.* (2) 9 (1890) 185-191; *Beibl.* (1890) 623.
- — —. Le rapport entre la vitesse de la lumière et la grandeur des molécules dans les milieux réfringents. *C.-R.* 115 (1892) 1061-1063.
- Julius, W.* Recherches bolométriques dans le spectre infra rouge. *Arch. néerland.* 22 (1887) 310-383; *Beibl.* (1889) 307.
- — —. Les raies doubles dans les spectres du sodium, du magnésium et de l'aluminium. *Ann. École polytechn. de Delft* 5 (1889) 1-117, 118-128; *Beibl.* (1889) 496-499; (1890) 40.
- Julius, W. H.* Die Licht- und Wärmestrahlung verbrannter Gase. *Gekrönte Preisarbeit, Berlin, 1890, 86 pp.*; *Beibl.* (1890) 602-615.
- — —. Bolometrische Untersuchung einiger Absorptionsspektren. *Verh. Akad. Amsterdam* 11 (1892), *Beibl.* (1893) 34.
- — —. Die Anwendung von dem Radiomikrometer zur Untersuchung des Wärmespektrums. *Handl. Nederl. Congres Amsterdam, 1895; Beibl.* (1896) 27.
- — —. Sur les ondes lumineuses sphériques et cylindriques. *Arch. néerland.* 28 (1895) 226-235.
- — —. Le quartz fondu et les bandes d'interférence dans le spectre des fils de quartz. *Arch. néerland.* 29 (1896) 454-465; *Beibl.* (1896) 539.
- Jung.* Refraktionsbestimmung mit Hilfe des Skiaskops nach Dr. Rindfleisch. *Centralztng. f. Optik* 14 (1893) 2-3.



## K

- Kahlbaum, G. W. A.** Ueber den neu entdeckten Bestandtheil der Atmosphäre, das Argon. Verh. d. Naturf. Ges. Basel (1895) 151-173.
- Kalähne, A.** Die Spektra einiger Elemente bei der stetigen Glimmentladung in Geissler'schen Röhren und die Abhängigkeit der Lichtstrahlung vom Stromstärke und Druck. Ann. Phys. n. F. 65 (1898) 815-848.
- Kalischer, S.** Elektrische Ausstrahlungen und das Leuchten in Geissler'schen Röhren. Naturwiss. Rundschau 10 (1895) 86-88.
- Kallir, J.** Krystallwassergehalt gelöster Cobaltsalze. Ann. Phys. n. F. 31 (1887) 1015.
- Kann, L.** Radiation phenomena of the Balmain Luminous Paint; Phys. Rev. 8 (1899) 250-251; Beibl. (1899) 486.
- Kanonnikoff, J.** Das Lichtbrechungsvermögen der Körper im flüssigen und gasförmigen Zustande. J. russ. phys. chem. Ges. 30 (1899) 965-975; Beibl. (1899) 768.
- Kapteyn, J. C.** New southern variable stars. Astron. Nachr. 142 (1896) 75-77.
- Kastle, J. H.** Color of salts in solution. Amer. Chem. J. 16 (1894) 326-340; Beibl. (1894) 912.
- — —. The color of the compounds of bromine and iodine. Amer. Chem. J. 21 (1899) 398-413; Beibl. (1899) 782.
- Kath, H.** Zur Phänomenänderung des Lichtes bei der Reflexion an Metallen. Ann. Phys. n. F. 62 (1897) 328-352.
- Katz, G. J.** Verschiebung der Absorptionsstreifen in verschiedenen Lösungsmitteln. Diss. Erlangen 1898; Beibl. (1898) 774.
- Kaufmann, W.** Emissionsvermögen einiger Metalle für Röntgen Strahlen. Verh. d. phys. Ges. 16 (1897) 116-118.
- Kayser, H., und C. Runge.** Die Spectra der Elemente. Abhandl. d. Berliner Akad. 1888, 93 pp.; (1889) 45 pp.; (1890) 66 pp.; (1891) 72 pp.; (1892) 177 pp., 28 pp.; Beibl. (1889) 78, 811.
- , ——. Die im galvanischen Lichtbogen auftretenden Bandenspectren der Kohle. Ann. Phys. n. F. 38 (1889) 80-90.
- —. Grünwald's "Mathematische Spektralanalyse." Chemiker Ztng. 13 (1889) 1655, 1687; Beibl. (1890) 278.
- —. Lehrbuch der Physik. für Studirende. Stuttgart, 1890, 464 pp.
- —. Mathematische Spectralanalyse. Chemiker Ztng. (1890) 325, 510.

- Kayser, H. (Cont'd), und C. Runge.* Linienspectra der Elemente, Spectra der Alkalien. Sitzb. Berliner Akad. (1890) 599-600.
- , ———. Spectra von Kupfer, Silber und Gold. Ann. Phys. n. F. 46 (1892) 225.
- , ———. Die Dispersion der Luft. Abhandl. d. preuss. Akad. (1893) 161-191; Ann. Phys. n. F. 46 (1893) 293.
- , ———. Spectren von Aluminium, Indium und Thallium. Ann. Phys. n. F. 48 (1893) 126.
- , ———. Die ultrarothten Spectren der Alkalien. Ann. Phys. n. F. 48 (1893) 150.
- , ———. Die Spectren der Elemente. 7er Abschnitt: Zinn, Blei, Arsen, Antimon und Wismuth. Abhandl. Berliner Akad. (1893) 20 pp.; Astrophys. J. 1 (1895) 91, abs.; Beibl. (1894) 93.
- , ———. Zur Kenntniss der Linienspectren. Ann. Phys. n. F. 51 (1894) 114; Astrophys. J. 1 (1895) 90, abs.
- —. Spectren der Kometen. Astron. Nachr. 134 (1894) 353-356; Beibl. (1894) 766.
- —. Note on the arc-spectrum of copper. Astrophys. J. 1 (1895) 84.
- —. Note on Helium and Argon. Chem. News 72 (1895) 89.
- —. The blue spectrum of Argon. Chem. News 72 (1895) 100.
- —. Die Spektren des Argons. Sitzb. Berliner Akad. (1896) 551-564; Astrophys. J. 3 (1896) 1-18; Beibl. (1896) 976.
- —. Die Bogenspektren der Elemente der Platingruppe. Abhandl. d. Berliner Akad. (1897) 44 pp.; Astrophys. J. 7 (1898) 93-114, 173-198; Beibl. (1898) 667.
- —. The Spectrum of  $\zeta$  Puppis. Astrophys. J. 5 (1897) 95-96.
- —. The spectrum of hydrogen. Astrophys. J. 5 (1897) 243.
- —. Handbuch der Spectroscopie. In fünf Bänden. Band I. Leipzig: S. Hirzel, 1900, xxv, 754 pp. (Promises to be the largest and most complete work on Spectroscopy.)
- Keeler, J. E.* Die Spectra von Saturn und Uranus. Astron. Nachr. 122 (1889) 401-404; Beibl. (1890) 119, 1100.
- — —. The chief line in the spectrum of the nebulae. Proc. Roy. Soc. 49 (1891) 399-403; Beibl. (1891) 647.
- — —. Observations of the spectrum of  $\beta$  Lyrae. Astron. and Astrophys. 12 (1893) 350-361; Beibl. (1894) 100.
- — —. The wave-lengths of the two brightest lines in the spectrum of nebulae. Astron. and Astrophys. 12 (1893) 730-736; Beibl. (1894) 566.

- Keeler, J. E.* The Spectra of the Orion Nebula and the Orion Stars. *Astron. and Astrophys.* 13 (1894) 476-494; *Beibl.* (1895) 68.
- — — Das Magnesiumspektrum als ein Index für die Temperatur der Sterne. *Astron. Nachr.* 136 (1894) 77-80; *Beibl.* (1895) 60.
- — — Schmidt's Theory of the Sun. *Astrophys. J.* 1 (1895) 178.—See Wilczynski, same vol. 112-126.
- — — Spectroscopic observations of Saturn at the Allegheny Observatory. *Science n. s.* 1 (1895) 519-520.
- — — Photographs of the spectrum of the ball and rings of Saturn. *Mon. Not.* 55 (1895) 474-475.
- — — Conditions affecting the form of lines in the spectrum of Saturn. *Astrophys. J.* 1 (1895) 63-68; *Beibl.* (1895) 200.
- — — A lens for adapting a visually corrected refracting telescope to photographic observations with the spectroscope. *Astrophys. J.* (1895) 101-111; *Beibl.* (1896) 25.
- — — The design of astronomical spectroscopes. *Astrophys. J.* 1 (1895) 248-252.
- — — The variable star 3416 S Velorum. *Astrophys. J.* 1 (1895) 262.
- — — A photographic correcting lens for visual telescopes. *Astrophys. J.* 1 (1895) 350-351.
- — — The displacement of spectral lines caused by the rotation of a planet. *Astrophys. J.* 1 (1895) 352-353.
- — — Dr. Pulfrich's modification of the Littrow spectroscope. *Astrophys. J.* 1 (1895) 353.
- — — A spectroscopic proof of the meteoric constitution of Saturn's rings. *Astrophys. J.* 1 (1895) 416-427; 2 (1895) 163; *Beibl.* (1896) 38 —See Deslandres, C.-R. 120 (1895) 1155.
- — — Note on the rotation of Saturn's Rings. *Astron. Nachr.* 139 (1895) 5-7; *Beibl.* (1896) 370.
- — — Recent researches bearing on the determination of wave-lengths in the infra-red spectrum. *Astrophys. J.* 3 (1896) 63-77; *Phil. Mag.* (5) 42 (1896) 77.
- — — Detection of the lines of water vapor in the spectrum of a planet. *Astrophys. J.* 4 (1896) 137.
- — — Measurement, by means of the spectroscope, of the velocity of rotation of planets. *Rept. Brit. Assoc.* (1896) 729-731.
- — — Spectrographic observations of Mars in 1896-1897. *Astrophys. J.* 5 (1897) 328-331.

- Keeler, J. E. (Cont'd).* The mode of printing maps of spectra and tables of wave-lengths. *Astrophys. J.* 6 (1897) 144.
- — —. The hydrogen atmosphere surrounding the Wolf-Rayet star D. M. + 30° 3639. *Astrophys. J.* 8 (1898) 113.
- — —. Some photographs of the Great Nebula in Orion, taken by means of the less refrangible rays of its spectrum. *Astrophys. J.* 9 (1899) 133-142.
- — —. The Ring Nebula in Lyra. *Astrophys. J.* 10 (1899) 193-201.
- — —. The Annular Nebula H IV 13 in Cygnus. *Astrophys. J.* 10 (1899) 266-268.
- Kehrmann, F.* Verbindungen des Kobaltoxyds. *Ber. chem. Ges.* 19 (1886) 3101.
- —. Azofarbstoffe, welche die Chinongruppe enthalten. *Chemiker Ztng.* 14 (1890) 93, 146-147.
- —. Beziehungen zwischen Färbung und chemischer Constitution. *Chemiker Ztng.* 14 (1890) 508, 527, 541; *Beibl.* (1890) 618.
- — und *N. Pickersgill.* Ursache des Auftretens der grünen Farbe bei der Electrolyse oxalsaurer Cobaltsalze. *Ber. chem. Ges.* 24 (1891) 2324-2326.
- —. Beobachtungen über die Beziehungen zwischen Farbe und chemischer Konstitution. *Verh. deutsch. Naturf. u. Ärzte* II 1 (1899) 89-91.
- Kelvin, Lord, and S. de Smolan.* The conductive effect produced in air by Röntgen rays and by ultraviolet light. *Nature* 55 (1887) 343-347.
- —. The generation of longitudinal waves in ether. *Proc. Roy. Soc.* 59 (1896) 270-273; *Nature* 53 (1896) 450-451.
- — *J. Carruthers Beattie, and S. de Smolan.* Phenomena produced in gases by Röntgen rays, by ultraviolet light, and by Uranium. *Proc. Roy. Soc. Edinburgh* 21 (1897) 393-428.
- —. The dynamical theory of refraction, dispersion, and anomalous dispersion. *Nature* 58 (1898) 546; *Rept. Brit. Assoc.* (1898) 782-783.
- —. Continuity in undulatory theory of condensational-rarefactional waves in gases, liquids, and solids, of distortional waves in solids, of electric waves in all substances capable of transmitting them, and of radiant heat, visible light, ultraviolet light. *Phil. Mag.* (5) 46 (1898) 494-500; *Nature* 59 (1898) 56-57; *Rept. Brit. Assoc.* (1898) 783-787.

- Kelvin, Lord* Application of Sellmeier's dynamical theory to the dark lines  $D_1$ ,  $D_2$  produced by Sodium vapour. *Edinb. Proc.* 22 (1899) 523-532; *Phil. Mag.* (5) 47 (1899) 302-308; *Beibl.* (1899) 769.
- —. Transparency and Opacity. *Nature* 60 (1899) 64-65.
- —. The reflection and refraction of solitary plane waves at a plane interface between two isotropic elastic mediums—fluid, solid, or ether. *Edinburgh Proc.* (1899) 366-379; *Phil. Mag.* (5) 47 (1899) 179-191.
- Kempf, P., and G. Muller.* Remarks on Prof. E. C. Pickering's article: "Comparison of photometric magnitudes of the stars," in *Astron. Nachr.* No. 3269. *Astrophys. J.* (1895) 428-432.
- Kerber, A.* Einige Satze uber die Vereinigung der heteronomen Strahlen. *Centralztng. f. Opt. u. Mech.* 12 (1891) 121-122, 133-134, 145-147, 158-161; *Beibl.* (1892) 148.
- —. Aufhebung des secundaren Spectrums durch Compensationslinien. *Centralztng. f. Opt. u. Mech.* 14 (1893) 145-147; *Beibl.* (1894) 336.
- —. Beitrage zur Dioptrik. Leipzig 1898, 16 pp.
- Kester, Fr. E.* A method for the study of phosphorescent sulphides. *Phys. Rev.* 9 (1899) 164-176.
- Ketteler, E., und C. Pulfrich.* Photometrische Untersuchungen. *Ann. Phys. n. F.* 15 (1882) 337.
- —. Grundzüge einer neuen Theorie der Volum- und Refraktionsäquivalente. *Ztsch. phys. Chem.* 2 (1888) 905; *Jahresb.* (1888) 428-432.
- —. Die Möglichkeit einer zugleich den elastisch optischen wie den electromagnetischen Principien entsprechenden Dispersionsformeln. *Ann. Phys. n. F.* 49 (1893) 382.
- —. Zur Theorie des Lichtes und insbesondere der doppelten Brechung. *Ann. Phys. n. F.* 49 (1893) 509.
- —. Ist es möglich die Erscheinungen der Dispersion des Lichtes kunstlich nachzubilden? *Ann. Phys. n. F.* 53 (1894) 823-831.
- —. Neue Form der Gesetze der Lichtbewegung in absorbierenden Krystallen und ihre Anwendung auf die Theorie der Totalreflexion. *Ann. Phys. n. F.* 56 (1895) 56-77, 540-555.
- Kiesewetter, K., und G. Kruss.* Zur Kenntniss der Absorptionsspectra erzeugenden seltenen Erden. *Ber. chem. Ges.* 21 (1888) 2310-2320; *Beibl.* (1889) 19.
- Killing, C.* Die Hypothese des Glühlichtes. *Beibl.* (1897) 863.
- —. Gasgluhlicht. *Beibl.* (1898) 313.

- Kipping, Fr. St., and W. J. Pope.* Optical inversion of camphor. J. Chem. Soc. 71 (1897) 956-962.
- Kirchhoff, G.* Abhandlungen über Emission und Absorption. Leipzig: Engelmann, 1898; Bible (1899) 140. (Rev. by E. Wiedemann)
- Klaassen, Helen G.* Change of phase on reflexion at the surface of highly absorbing media. Phil. Mag (5) 44 (1897) 349-356; Beibl. (1898) 565.
- Klaer, J.* Die Theorie der Cometenschweife. Astron. Nachr. 126 (1890) 281-292, Beibl. (1891) 646.
- Klar, K.* Die Theorie des Glühens. Centralztng. f. Opt. 8 (1887) 109-111.
- Klatt, V., und Ph. Lenard.* Die Phosphoreszenzen des Kupfers, Wismuths und Mangans in den Erdalkalisulfiden. Ann. Phys. n. F. 38 (1889) 90-107
- Kleefeld.* Fluorescirende Opale. N. Jahrb. Min. Geol. Pal. 2 (1895) 146-147; Ztsch. Kryst. u. Min. 28 (1897) 619.
- Klein, H. J.* Krystallographisch-optische Untersuchungen an Rhodizit, Jeremejewitt, Analcim, Chabazit und Phakolith. Sitzb. Berliner Akad. (1890) 703-733.
- . Der grosse Nebel in Orion. Sirius 24 (1895) 14-17.
- . Die Spektra der hellen Sternen nach den photographischen Aufnahmen auf dem astrophysikalischen Observatorium zu Potsdam. Sirius 24 (1895) 202-208.
- . Sonnenflecken, Kometen, Klimaschwankungen. Sirius 24 (1896) 265-268.
- Klumpke, Mlle. D.* L'étude des spectres stellaires Bull. astron. 7 (1890) 287-294; Beibl. (1890) 1100.
- Knoblauch, O.* Photoluminescenz. Tagebl. d. Naturf. Vers. 62 (1889) 200-201; Beibl. (1891) 650.
- . Fluorescenz von Lösungen. Ann. Phys. n. F. 54 (1895) 193-220.
- Knopf, O.* Die Schmidt'sche Sonnentheorie und ihre Anwendung auf die Methode der spectroscopischen Bestimmung der Rotationsdauer der Sonne. Astron. Nachr. 134 (1893) 105-120; Beibl. (1893) 930; (1894) 670; Vierteljahrsschr. d. astron. Ges. 30 (1895) 24-39.
- Knops, C.* Die Molekularrefraction der Isomeren. Liebig's Ann. 248 (1888) 175-231.
- Kobold, H.* Zur Bessel'schen Methode der Untersuchung der Eigenbewegungen. Astron. Nachr. 137 (1895) 343-348; 138 (1895) 243-246; Beibl. (1896) 32, 371.



- Koch, G. R.* Spectra der Gase bei tiefen Temperaturen. Ann Phys. n. F. 38 (1889) 213; Jahresb. (1889) 318.
- Kock, E.* Absorptionsspectren einiger Nitrosoverbindungen, den von Kruss und Oecomenides aufgestellten Satz bestätigend. Ann. Phys. n. F. 32 (1887) 167.
- Kohl, F. G.* Die assimilatorische Energie der blauen und violetten Strahlen des Spektrums. Naturwiss. Rund. 12 (1897) 425; Beibl. (1897) 983.
- Kolacek, F.* Eine Dispersionserklärung vom Standpunkte der elektromagnetischen Lichttheorie. Ann. Phys. n. F. 32 (1887) 224–256, 428.—See Kundt, Ann. Phys. 142 (1871) 163; Sellmeier, Ann. Phys. 145 (1872) 339, 147 (1872) 386; Sir William Thomson, Nature 31 (1885) 461, 508, 601.
- Konen, H.* Ueber die Spektren des Iod. Diss. Bonn, 1897. 72 pp.; Ann. Phys. n. F. 65 (1898) 257–286.
- König, A.* Helligkeitswerth der Spectralfarben bei verschiedener absoluter Intensität. Ann. Phys. n. F. 45 (1892) 604.
- — — Neues Spectralphotometer. Ann. Phys. n. F. 46 (1896) 527.
- — — und C. Dieterici. Die Grundempfindungen in normalen und anormalen Farbensystemen und ihre Intensitätsvertheilung im Spectrum. Ztsch. Psych. u. Phys. d. Sinnesorg. 4 (1892) 241–347; Beibl. (1894) 355.
- — — Theorie der Fresnel'schen Beugungsspectra. Diss. Jena, 1895.
- — — Anzahl der unterscheidbaren Spectralfarben und Helligkeitsstufen. Ztsch. f. Psychol. u. Physiol. 8 (1894) 375–380; Beibl. (1895) 642.
- — — Quantitative Bestimmung an complementären Spectralfarben. Sitzb. Berliner Akad. (1896) 945–949.
- — — Abhängigkeit der Sehscharfe von der Beleuchtungsintensität. Verh. d. phys. Ges. Berlin 16 (1897) 128; Sitzb. Berliner Akad. (1897) 559–575.
- — — — — Blaublindheit. Sitzb. Berliner Akad. (1897) 720–731.
- — — — — Die Abhängigkeit der Farben- und Helligkeitsgleichungen von der absoluten Intensität. Sitzb. Berliner Akad. 39 (1897) 871–882.
- König, W.* Ueber die Entstehung der Kundt'schen Staubfiguren. Ber. d. k. sachs. Ges. d. Wiss. (1890) 46–54.
- — — Einige Fälle achromatischer Interferenzen. Ann. Phys. n. F. 55 (1895) 1–43.

- König, W. (Cont'd).* Einfache Herleitung der Grunformeln der shärischen Spiegelung und Brechung aus dem Huyghens'schen Principe. Ztsch. phys. u. chem. Unterr. 8 (1895) 260–264.
- . Ueber Röntgen'sche Strahlen. Ztsch. f. Elektrochem. 3 (1896) 54–61.
- . Beobachtung des Zeeman'schen Phänomens. Ann. Phys. n. F. 62 (1897) 240–248; 63 (1897) 268–272.
- . Phosphoreszenz fester Kohlensäure. Beibl. (1898) 563.
- Königsberger, J.* Absorption von ultrarothem Strahlen in doppelbrechenden Krystallen. Ann. Phys. n. F. 61 (1897) 687–704.
- Konkoly, N. von.* Beobachtungen angestellt am astrophysikalischen Observatorium in O'Gyalla (1892–1893). Halle: Schmidt, 1894. 107 pp.
- Konowalow, M.* Brechungsvermögen einiger Stickstoffverbindungen. J. russ. phys. chem. Ges. (7) 27 (1897) 412–421; Beibl. (1897) 966.
- Körber, F.* Die Spektralanalyse. Beibl. (1899) 177.
- Kostanecki, St. von.* Die Farbeigenschaften der Nitrosoxycholine. Ber. chem. Ges. 24 (1891) 150–156.
- Köttgen, Else.* Spectrale Zusammensetzung verschiedener Lichtquellen. Ann. Phys. n. F. 53 (1894) 793–811.
- Kövesligethy, R. von.* Theorie der continuirlichen Spectra. Ber. aus Ungarn 4 (1885–1886) 9–10, 4 (1886–1887) 20–28.
- . Emission glühender, fester Körper. Ann. Phys. n. F. 32 (1887) 699.
- . Michelson's Spectraltheorie. Ber. aus Ungarn 7 (1889) 24–35; Beibl. (1890) 116.
- . Grundzüge einer theoretischen Spektralanalyse. Halle a. S.: H. W. Schmidt, 1890, xi–327 pp.; Beibl. (1890) 852.
- Kowalewski, W. A.* Das Atomvolum und die Molekularrefraction in den Chloranhydriden der Alkylphosphorsäuren. J. russ. phys. chem. Ges. 29 (1897) 217–222; Beibl. (1897) 968.
- Krafft, F.* Einige hochmoleculare Benzolderivate. Ber. chem. Ges. 21 (1888) 2261–2271, 3180–3188.
- Kral, H.* Herstellung von Natriumlicht. Beibl. (1893) 747.
- Kreutz, F.* Steinsalz und Fluorit, ihre Farbe, Fluoreszenz und Phosphoreszenz. Anz. d. Akad. Krakau (1895) 118–127; Beibl. (1895) 636.
- Krieger, J. N.* Der Lichtschein im Plato. Sirius 23 (1895) 270; 26 (1897) 49–52.



- Krone, H. von* Farbenphotogramme von Spectren. *Ann. Phys.* n. F. 46 (1892) 426; *Photogr. Mittheil.* 29 (1892) 67-70; 30 (1893) 133-135, 148-150, *Beibl.* (1894) 192.
- — Absorption des Lichtes, Fluorescenz, Phosphorescenz. *Jahrb. f. Photogr.* 10 (1896) 152-160; 11 (1897) 80-87; *Beibl.* (1897) 31, 978.
- — Das dunkle Licht und seine graphischen Wirkungen. *Ver. deutsch. Naturf. u. Aerzte* II 1 (1899) 171.
- Krueger, F.* Absorptionsverhältniss des Oxyhamoglobins. *Ztsch. f. Biol.* 24 (1888) 47.
- — Catalog der farbigen Sterne zwischen dem Nordpol und 23. Gradsüdlicher Declination mit besonderer Berücksichtigung des Spectraltypus. *Pub. d. Sternw. in Kiel* 8 (1893) 145 pp.; *Beibl.* (1894) 98.
- — Bemerkung zu Espin: "Stars with remarkable spectra." *Astron. Nachr.* 138 (1895) 111.
- — Spectroskopische Beobachtungen farbiger Sterne. *Astron. Nachr.* 138 (1895) 239; 139 (1896) 243-248.
- Krusa, O.* Phosphorescirende Flächen und Sensitometer. *Jahrb. f. Photogr.* (1893) 189-191; *Beibl.* (1893) 1070.
- Kruss, G.* Untersuchungen über Gold. *Liebig's Ann.* 238 (1887) 30-77, 241-275; *Jahresb.* (1887) 602-605; *Beibl.* (1887) 703.
- — und *L. F. Nilson.* Die Componenten der Absorptionsspectra erzeugenden Componenten. *Ber. chem. Ges.* 20 (1887) 2134-2171, 3067-3072; 21 (1888) 585-589.—See *G. H. Bailey*, *Ber. chem. Ges.* 20 (1887) 2069-2070; and *J. B. Bailey*, same vol. 3325-3326.
- — Photometrische Messungen von Lichtquellen. *Centralztng. f. Opt. u. Mech.* 8 (1887) 87-89; *Ann. Phys. n. F.* 11 (1887) 581.
- — Zusammensetzung und Absorptionsspectren organischer Verbindungen. *Ztsch. phys. Chem.* 2 (1888) 312-337; 15 (1895) 559-562.; *Beibl.* (1888) 789-790; (1896) 197.
- — und *H. Mohralt.* Zur spectrocolorimetrischen Eisenbezw. Rhodanbestimmung. *Ber. chem. Ges.* 22 (1889) 2054-2060.
- — Zur Chemie des Erbiums und Didyms. *Liebig's Ann.* 265 (1891) 1-27.
- —, und *H. Kruess.* Colorimetrie und quantitative Spectralanalyse in ihrer Anwendung in der Chemie. Leipzig: L. Voss, 1891, VIII u. 291 pp.; *Beibl.* (1891) 236.

- Kruss, G. (Cont'd).* Beiträge zur quantitativen Spectralanalyse. Ztsch. anorgan. Chem. 1 (1892) 104-126; Beibl. (1892) 606.
- — und *E. Thiele*. Lösungszustand des Iod und die wahrscheinliche Ursache der Farbenunterschiede seiner Lösungen. Ztsch. anorg. Chem. 7 (1894) 52-81; Beibl. (1894) 1047.
- — und *H. Kruess*. Neue Methode der quantitativen Spectralanalyse. Ztsch. f. anorgan. Chem. 10 (1895) 31-43; Beibl. (1896) 26.
- —. Beobachtungen an veränderlichen Sternen. Astron. Nachr. 141 (1896) 203-205.
- Kruss, H.* Repetitionsspectrometer und Goniometer. Ztsch. f. Instrum. 7 (1887) 215-218; Beibl. (1887) 700.
- —. Automatisches Spectroscop mit festem Beobachtungsfernrohr. Ztsch. f. Instrum. 8 (1888) 388-392; Beibl. (1889) 79.
- —. Lichtverlust in sogenannten durchsichtigen Körpern. Abhandl. d. Natur. Ver. Hamburg (1889) 1-28; Beibl. (1890) 372.
- —. Bolometrische Untersuchungen über Lichteinheiten. J. F. Gasbeleucht. (1895) 3 pp.
- —. Apparat für die Zwecke der quantitativen Spectralanalyse. Ztsch. f. Instrum. 15 (1895) 407.
- —. Forschungsergebnisse auf dem Gebiete der Lichtemission. Jour. f. Gasbel. u. Wasserversorg. (1896) 4 pp.; Beibl. (1896) 772.
- —. Versuche mit dem "Flacker" Photometer von O. N. Rood. J. f. Gasbel. (1896) 3 pp.; Beibl. (1896) 772.
- —. Photometer nach Lummer und Brodhun mit Gradbogen zur Messung der Lichtausstrahlung unter verschiedenen Winkeln. Jour. f. Gasbel. (1896) 265-266; Beibl. (1896) 773.
- —. Ein neues Verfahren in der quantitativen Spektralanalyse. Verh. deutsch. Naturf. u. Aerzte (1896) 76-77.
- —. Bericht über die Arbeiten der Lichtmess-Kommission. München; R. Oldenburg, 1897, 116 pp.; Beibl. (1898) 218.
- —. Spektrophotometer mit Lummer-Brodhun'schem Prismenpaar. Ztsch. f. Instrum. (1898) 12-18; Beibl. (1898) 839.
- Künan, J. P., und W. W. Randall.* The expansion of argon and helium as compared with that of air and hydrogen. Proc. Roy. Soc. 59 (1896) 60-66.
- Kundt, A.* Doppelbrechung an Metallschichten. Ann. Phys. n. F. 27 (1886) 59; Jahresb. (1886) 300.
- —. Bestimmung der Brechungsexponenten von Metallen. Sitzb. Berliner Akad. (1888) 255; Phil. Mag. (5) 26 (1888) 1.

- Kundt, A.* Aenderung der Lichtgeschwindigkeit in den Metallen mit der Temperatur Sitzb. Berliner Akad. (1888) 1387-1394. Jahresb. (1888) 425.
- Kurlbaum, F.* Bestimmung der Wellenlänge Fraunhofer'schen Linien. Ann. Phys. n. F. 33 (1888) 159-194, 381-413
- —. Methode zur quantitativen Bestimmung strahlender Wärme. Ann. Phys. n. F. 51 (1894) 591.
- — und *O. Lummer*. Die neue Platineinheit der Physikalisch-technischen Reichsanstalt. Verh. d. phys. Ges. Berlin (1896) 56-70.
- —. Eine bolometrische Versuchsanordnung für Strahlungen zwischen Körpern von sehr kleiner Temperaturdifferenz und eine Bestimmung der Absorption langer Wellen in Kohlensäure. Ann. Phys. n. F. 61 (1897) 417-435.
- —. Aenderung der Emission und Absorption von Platinschwarz und Russ mit zunehmender Schichtdicke. Ann. Phys. n. F. 67 (1899) 846-858.
- Kurnakow, N. S.* Beziehungen zwischen der Farbe und der Konstitution der Haloddoppelsalze. Ztsch. f. anorg. Chem. 17 (1898) 207-235; Beibl. (1898) 775.
- Kurz, A.* Minimum der prismatischen Ablenkung. Repert d. Phys. 26 (1890) 177-178.
- —. Die kleinste Ablenkung im Prisma. Ztsch. f. Math. u. Phys. 37 (1892) 317-318, 38 (1893) 319-320; Beibl. (1894) 183.
- Kuster, F. W.* Die blaue Iodstärke und die molekulare Structur der "gelösten" Stärke. Ver. deutsch. Naturf. u. Aerzte (1895) 98-103; Ber. chem. Ges. 28 (1895) 783 785.
- Kutscher, Fr.* Physiologie der Phosphorescenz. Ztsch. physiol. Chem. 23 (1897) 109-114; Beibl. (1898) 316.

## L

- Labatut, L.* L'absorption et la photographie en couleurs. C. R. 113 (1891) 126-129, Beibl. (1892) 364.
- Lachowicz, Br.* Absorption der strahlenden Wärme durch die Flüssigkeiten. Ber. chem. Ges. 20 (1887) 735-743; Beibl. (1887) 708.
- Ladd, Ch. F.* Neue Theorie der Lichtempfindungen. Ztsch. Psychol. u. Physiol. 4 (1892) 211 222
- Lagerborg, N.* Veränderung der Dichte und des Brechungsindex von Steinsalz. Beibl. (1889) 490.

- Laska, V.* Ueber den Nebel im Orion. *Sirius* 23 (1895) 136-137.
- Lca, M. C.* Red and purple chloride, bromide, and iodide of silver. *Amer. J. Sci.* 33 (1887) 349-364, 488; *Beibl.* (1888) 50.
- —. The nature of certain solutions, and on a new means of investigating them. *Phil. Mag.* (5) 36 (1893) 88-98.
- —. The color relations of atoms, ions, and molecules. *Amer. J. Sci.* (3) 49 (1895) 357-374; *Beibl.* (1895) 886; (1896) 695.
- —. Röntgen rays not present in sunlight. *Amer. J. Sci.* (4) 1 (1896) 363-364.
- Leblanc, M.* Optisch-chemische Studien. *Ztsch. phys. Chem.* 4 (1889) 553-560; *Beibl.* (1890) 272.
- —. Einfache Methode zur Bestimmung von Brechungsexponenten optisch-isotroper Körper. *Ztsch. phys. Chem.* 10 (1892) 433-449; *Beibl.* (1893) 441.
- — und *P. Rohland.* Ueber den Einfluss, welchen die elektrolytische Dissociation, der Wechsel des Aggregatzustandes und des Lösungsmittels auf das Lichtbrechungsvermögen einiger Stoffen ausüben. *Ztsch. phys. Chem.* 19 (1896) 261-286; *Beibl.* (1896) 364.
- Le Bon, G.* La photographie à la lumière noire. *C.-R.* 122 (1896) 188-190, 233-235.—See *Niewenglowski*, same vol. 232-233.
- —. Nature et propriétés de la lumière noire. *C.-R.* 122 (1896) 386-390, 462-463, 522-524, 1054-1057.
- —. Nature de diverses espèces de radiations produites par les corps sous l'influence de la lumière. *C.-R.* 124 (1897) 755-758, 1140-1151.—See *Becquerel*, same vol. 984.
- —. Sur la persistance de la luminescence invisible. *C.-R.* 128 (1899) 174-176; *Beibl.* (1899) 387.
- —. La transparence des corps opaques pour les radiations lumineuses de grande longueur d'onde. *C.-R.* 128 (1899) 297-300.
- Leduc, A.* Note historique sur l'influence du mouvement de la terre sur les phénomènes de la réfraction. *J. de phys.* (3) 4 (1895) 106-109.
- —. Sur les densités de l'azote, de l'oxygène et de l'argon, et la composition de l'air atmosphérique. *C.-R.* 123 (1896) 805-807.
- Lefèvre, Julien.* La Spectroscopie. Paris: Gauthier-Villars, 1896, 8vo., 188 pp.
- —. La Spectrométrie. Appareils et mesures. Paris: Gauthier-Villars, 1896, 212 pp.

- Lehmann-Filhes, R.* Die Bestimmung einer Doppelsternbahn aus spectroscopischen Messungen der im Visionsradius liegenden Geschwindigkeitscomponente *Astron. Nachr.* 136 (1894) 17-30.
- . Ueber den Artikel des Herrn —See in *Astron. Nachr.* 3314 (Spectroscopy of Binary Systems). *Astron. Nachr.* 139 (1896) 305-310.
- Leiss, C.* Ein neues, aus Kalkspat und Glas zusammengesetztes Nicol'sches Prisma *Sitzb. Berliner Akad.* 40 (1897) 901-904.
- . Neuere spectrophotographische Apparate. *Beibl.* (1898) 221, 249; (1899) 767, 796.
- Leuard, Ph., und M. Wolf.* Chemiluminescenz bei der Oxydation der Pyrogallussaure. *Ann. Phys. n. F.* 34 (1888) 918.
- . Zerstauben der Körper durch ultraviolette Licht. *Ann. Phys. n. F.* 37 (1889) 443-447.
- . Die Absorption der Kathodenstrahlen. *Ann. Phys. n. F.* 56 (1895) 255-275.
- . Die Eigenschaften der Kathodenstrahlen verschiedener Ablenkbarkeit. *Verh. deutsch. Naturf. u. Aerzte II* 1 (1897) 69-70.
- Lepinay, J. Macé de.* Méthode pour mesurer en longueurs d'onde de petites épaisseurs. *Ann. chim. phys.* (6) 10 (1887) 68-85; *Beibl.* (1887) 442.
- . Détermination de la valeur absolue de la longueur d'onde de la raie D. *Ann. chim. phys.* (6) 10 (1887) 170-200.
- . Indices du quartz dans le spectre visible. *J. de phys.* 6 (1887) 190-201; *Beibl.* (1887) 786.
- . Les franges d'interférence produites par des sources lumineuses étendues. *C.-R.* 109 (1889) 137-139; *Beibl.* (1890) 121.
- . La localisation des franges d'interférence des lames minces isotropes. *C.-R.* 109 (1889) 893-895; *J. de phys.* (2) 9 (1890) 121-135, 180-185; *Beibl.* (1890) 286; (1891) 648.
- et *A. Perot.* Franges achromatiques produites par les demi-lentilles de Billet. *J. de phys.* (2) 9 (1890) 376-381.
- et *Ch. Fabry.* Théorie générale de la visibilité des franges d'interférence. *C.-R.* 110 (1890) 895-898; *J. de phys.* (2) 10 (1891) 5-20; *Beibl.* (1890) 799; (1891) 356.
- . Quelques cas particuliers de visibilité des franges d'interférence. *C.-R.* 110 (1890) 997-1000; *Beibl.* (1890) 989.
- . La double réfraction du quartz. *J. de phys.* (3) 1 (1892) 23-31.

- Lépinay, J. Macé de (Cont'd).* Les franges des caustiques. C.-R. 116 (1893) 312-315.
- —. Les franges de Herschel. J. de phys. (3) 3 (1894) 163-168.
- —. Achromatisme et chromatisme des franges d'interférence. C.-R. 118 (1894) 585-588, 856-859; J. de phys. (3) 3 (1894) 241-257; Beibl. (1894) 769.
- —. Mesures optiques d'étalons d'épaisseur. Ann. chim. phys. (7) 5 (1895) 210-256.—See Pellat, J. de phys. (2) 10 (1891) 389; and Lépinay, J. de phys. (2) 7 (1888) 53.
- —. Les changements de phase par diffraction. J. de phys. 5 (1896) 303-306.
- —. Les franges des caustiques et les arcs surnuméraires de l'arc en ciel. J. de phys. (2) 7 (1898) 209-216; Beibl. (1899) 30.
- —. Le calcul des coefficients de la série de Fourier. J. de phys. 8 (1899) 137-148.
- Lepsius, R.* Die Einwirkung des elektrischen Lichtbogens auf gasförmige Körper und die Benutzung desselben zu Demonstrationen. Ber. chem. Ges. 23 (1890) 1418-1428, 1637-1642.
- Leroy, C. J. A.* Champ optique, champ visuel absolu et relatif de l'œil humain. C.-R. 116 (1893) 377-379.
- Lewes, V. B.* Luminous gases. Chem. News 63 (1891) 3-5, 15-16, 32-33, 40-43; Beibl. (1891) 204.
- —. Luminosity of coal-gas flames. Chem. News 65 (1892) 79-81, 99-101, 125-126; Beibl. (1893) 747.
- —. The cause of luminosity in the flames of hydrocarbon gases. Proc. Roy. Soc. 57 (1895) 181, 450-468; Chem. News 71 (1895) 190-192, 203-205; Beibl. (1895) 692.
- —. The acetylene theory of luminosity. J. Chem. Soc. 69-70 (1896) 226-243; Beibl. (1896) 367.
- Lewis, E. P., and E. S. Ferry.* The infra-red spectra of metals. Johns Hopkins Cir. No. 12; Astron. and Astrophys. 13 (1894) 742-752; Beibl. (1895) 242.
- —. The measurement of some standard wave-lengths in the infra-red spectra of the elements. Astrophys. J. 1 (1895) 1-25, 106-108; Beibl. (1896) 28.
- —. The infra-red spectra of the elements. Johns Hopkins Cir. 14 (1895) 70-71; Beibl. (1895) 784.
- —. The effect of certain impurities on the spectra of some gases. Astrophys. J. 10 (1899) 137-163.



- Lie, S.* Die infinitesimalen Berührungstransformationen der Optik. Verh. d. Sachs. Ges. d. Wiss. (1896) 131-133; Beibl. (1897) 331.
- Liebenthal, E.* Zur Theorie des Bunsen'schen Photometers. Beibl. (1889) 674.
- —. Lichtverteilung und Methoden der Photometrirung von elektrischen Glühlampen. Ztsch. f. Instrum. 19 (1899) 193-206, 225-240.
- Liebermann, C.* Absorptionsspectra der Aether der Oxanthrachinone. Ber. chem. Ges. 21 (1888) 2527; Jahresb. (1888) 443.
- — und *H. Finkelbeiner.* Optisch actives Zimmtsäuredichlorid. Ber. chem. Ges. 26 (1893) 833-834.
- — und *A. Hartmann.* Optisch active Zimmtsäurebromide. Ber. chem. Ges. 26 (1893) 829-833.
- Liebisch, Th.* Das Minimum der Ablenkung durch Prismen optisch zweiaxiger Krystalle. Gött. Nachr. (1888) 197-201.
- —. Absorptionsbuschel pleochroistischer Krystalle. Gött. Nachr. (1888) 202-210.
- —. Die Spectralanalyse der Interferenzfarben optisch zweiaxiger Krystalle. Gött. Nachr. (1893) 265-266; Beibl. (1894) 575.
- Lienard, A.* La théorie de Lorentz et celle de Larmor. Eclair. électr. 16 (1898) 330-334, 360-365, Beibl. (1899) 54.
- Liesegang, R. E.* Diffusionserscheinungen bei den photographischen Processen. Beibl. (1897) 982.
- Limb, C.* Sur un procédé possible de séparation de l'argon et de l'azote atmosphérique. C.-R. 121 (1895) 887-888.
- Lindemann, E.* Eine von Prof. Ceraski angedeutete persönliche Gleichung bei Helligkeitsvergleichen der Sterne. Bull. Acad. St. Petersb. Mélanges 7 (1890) 83-88; Beibl. (1891) 354.
- —. Die Lichtcurve des neuen Sterns von 1892 (T Aurigae). Bull. Acad. St. Petersb. n. s. 3 (1893) 507-530, Beibl. (1894) 101.
- —. Helligkeitsmessungen von Z Herculis. Astron. Nachr. 137 (1894) 10.
- —. Photometrische Messungen von T Andromedae. Astron. Nachr. 139 (1896) 345-347.
- Linnemann, E.* Die Absorptionserscheinungen in Zirkonen. Didymium. Monatsh. f. Chem. 6 (1885) 531-536.
- Linossier, G.* Spectroscopische Nachweis von Blut. Chem. Centralbl. (1889 b) 816; Jahresb. (1889) 255-257.

- Lippmann, G.* La photographie des couleurs. C.-R. 112 (1891) 274-275; Beibl. (1891) 282.—See C.-R. 112 (1891) 275-277, E. Becquerel.
- . La photographie des couleurs. C.-R. 114 (1892) 961-962; Beibl. (1892) 611; Nature 46 (1892) 12-13.
- . Photographies colorées du spectre sur albumine et sur gélatine bichromatées. C.-R. 115 (1892) 575-576; Beibl. (1893) 933.
- . La théorie de la photographie des couleurs simples et composées par la méthode interférentielle. J. de phys. (3) 3 (1894) 97-107; Beibl. (1894) 761.
- . Colour Photography. Read before the Roy. Inst. Gt. Brit. April 17, 1896; Proc. Roy. Soc. 60 (1896) 10-13; Beibl. (1897) 418.
- . La photographie des couleurs. Bull. Soc. astron. de France (1897) 280-283.
- Littlewood, T. H.* A method of finding the refractive index of a liquid; applicable when the liquid is not homogeneous. Phil. Mag. (5) 37 (1894) 467-470.
- Liveing, G. D., and J. Dewar.* The Spectrum of the Oxyhydrogen Flame. Proc. Roy. Soc. 43 (1887) 340-347; Phil. Trans. 179 A (1888) 27-42; Beibl. (1889) 216.
- , ———. The Ultra-Violet Spectra of the Elements. III, Cobalt and Nickel. Phil. Trans 179 I (1888) 231-256; Nature 36 (1888) 126; Beibl. (1889) 217.
- , ———. Investigations on the spectrum of magnesium. Proc. Roy. Soc. 44 (1888) 241-252; Beibl. (1889) 381.
- , ———. The absorption spectrum, luminous and ultra-violet of large masses of oxygen. Phil. Mag. (5) 26 (1886) 286-291; Beibl. (1888) 582.
- , ———. Notes on the absorption-spectra of oxygen and some of the compounds. Proc. Roy. Soc. 46 (1889) 222-230; Beibl. (1889) 946-947.
- ———. Solution and crystallization. Cambridge Trans. 15 I (1890) 19 pp.
- ———. Crystallization. Nature 44 (1891) 156-160.
- ——— and J. Dewar. The spectroscopic peculiarities of dust. Proc. Roy. Soc. 48 (1891) 437-440; Beibl. (1891) 279.
- , ———. On the influence of pressure on the spectra of flames. Chem. News 63 (1891) 155-156; Proc. Roy. Soc. 49 (1891) 143-145, 217-225; Beibl. (1891) 514.



- Living, G. D. and J. Dewar (Cont'd).* Note on the spectra of the flames of some metallic compounds. *Proc. Roy. Soc.* 52 (1892-1893) 117-123; *Beibl.* (1893) 1056.
- . The spectrum of liquid oxygen and the refractive indices of liquid oxygen, nitrous oxide, and ethylene. *Phil. Mag.* (5) 34 (1892) 205-209; *Beibl.* (1893) 121.
- . Note on Plucker's supposed detection of the line-spectrum of hydrogen in the oxyhydrogen flame. *Phil. Mag.* (5) 34 (1892) 371-374; *Beibl.* (1893) 925.
- . On the refractive indices of liquid nitrogen and air. *Phil. Mag.* (5) 36 (1893) 328-331; *Beibl.* (1894) 334.
- . Preliminary note on the spectrum of the electric discharge in liquid oxygen, air, and nitrogen. *Phil. Mag.* (5) 37 (1894) 235-249; *Beibl.* (1895) 60.
- . On Benham's Artificial Spectrum. *Cambridge Proc.* 8 IV (1895) 249.
- . The refraction and dispersion of liquid oxygen, and the absorption spectrum of liquid air. *Phil. Mag.* (5) 39 (1895) 268-272; *Beibl.* (1896) 193.
- . On photographing the whole length of a spectrum at once. *Cambridge Proc.* 9 (1896) 141-142.
- . The flame spectrum of mercury, and its bearing on the distribution of energy in gases. *Cambridge Proc.* 10 (1899) 38-40; *Beibl.* (1899) 781.
- . The variation of intensity of the absorption bands of different didymium salts dissolved in water, and its bearing on the ionization theory of the colour of solutions of salts. *Cambridge Proc.* 10 (1899) 40-44; *Beibl.* (1899) 782.
- Lockyer, J. N.* Notes on the spectrum of Aurora. *Nature* 36 (1887) 358.
- . Spectra of Meteorites. *Proc. Roy. Soc.* 43 (1887) 117-156; *Beibl.* (1888) 357; *Nature* 36 (1887) 55-61, 80-87; 38 (1888) 139-142, 428-430, 456-458, 530-533, 556-559, 602-605; 39 (1888) 139-142; *Beibl.* (1889) 220, 508.
- . The spectra of meteorites compared with the solar spectrum. *Rept. Brit. Assoc.* (1888) 576.
- . The spectrum of the Rings of Saturn. *Nature* 38 (1888) 564.
- . Classification of the various species of heavenly bodies. *Proc. Roy. Soc.* 43 (1888) 1-93; *Beibl.* (1888) 582; (1889) 504.

- Lockyer, J. N. (Cont'd).* Spectre maximum de Mira Ceti. C.-R. 107 (1888) 832-834; Beibl. (1889) 220,
- — —. The physical and chemical characteristics of meteorites as throwing light upon their past history. *Nature* 40 (1889) 305-309; Beibl. (1890) 844.
- — —. Note on the spectrum of Saturn's Rings. *Proc. Roy. Soc.* 45 (1889) 315-316; Beibl. (1889) 509.
- — —. The wave-length of a chief fluting seen in the spectrum of magnesium. *Proc. Roy. Soc.* 46 (1889) 35-40; Beibl. (1889) 812.
- — —. On the spectra of meteor swarms, Group III. *Proc. Roy. Soc.* 46 (1889) 380-392; Beibl. (1889) 688.
- — —. The causes of variability in condensing swarms of meteorites. *Proc. Roy. Soc.* 46 (1889) 401-423; Beibl. (1890) 515.
- — —. Note sur le spectre d'Uranus. C.-R. 108 (1889) 1149-1151.
- — —. Comparison of the spectra of nebulae and stars of groups I and II with those of comets and aurorae. *Proc. Roy. Soc.* 47 (1890) 28-39; Beibl. (1890) 516.
- — —. The presence of bright carbon flutings in the spectra of celestial bodies. *Proc. Roy. Soc.* 47 (1890) 39-41; Beibl. (1890) 516.
- — —. The principal line in the spectra of nebulae. *Proc. Roy. Soc.* 48 (1890) 167-198; Beibl. (1890) 1101.
- — —. Note on the spectrum of the nebula of Orion. *Proc. Roy. Soc.* 48 (1890) 198-199; Beibl. (1890) 1101.
- — —. Preliminary note on photographs of the spectrum of nebula in Orion. *Proc. Roy. Soc.* 48 (1890) 199-201; Beibl. (1890) 1101.
- — —. On the spectrum of Comet *a* 1890 and of the Nebula G. C. 4058. *Proc. Roy. Soc.* 48 (1890) 217-220; Beibl. (1891) 35.
- — —. Stellar Changes. *Nature* 42 (1890) 545-551; Beibl. (1891) 109.
- — —. The causes which produce the phenomena of new stars. *Proc. Roy. Soc.* 49 (1891) 443-446; *Phil. Trans.* 182 (1891) 397-448; Beibl. (1891) 647; (1893) 1067.
- — —. The new star in Auriga, preliminary note. *Proc. Roy. Soc.* 50 (1891) 407-409, 466-469.
- — —. The photographic spectra of some of the brighter stars. *Proc. Roy. Soc.* 52 (1892) 326-331; Beibl. (1893) 830.

- Lockyer, J. N.* The photographic spectrum of electrolytic iron. *Proc. Roy. Soc.* 54 (1893) 359-361.
- — — The photographic spectrum of the great nebula of Orion. *Astron. and Astrophys.* 13 (1894) 574-575; *Proc. Roy. Soc.* 56 (1894) 285; *Phil. Trans.* 186 A (1895) 73-91; *Astrophys. J.* 3 (1896) 229-232.
- — — The photographic spectra of some of the brighter stars. *Phil. Trans.* 184 (1894) 675-727.
- — — The photographic arc-spectrum of iron-meteorites. *Proc. Roy. Soc.* 54 (1894) 130-141; *Beibl.* (1894) 767.
- — — The spectrum changes in  $\beta$  Lyrae. *Astron. and Astrophys.* 13 (1894) 575-581; *Proc. Roy. Soc.* 56 (1894) 278-285.
- — — Preliminary report on the results obtained with the prismatic cameras during the total eclipse of the Sun, April 16, 1893. *Phil. Trans.* 185 A (1895) 711-719; *Beibl.* (1894) 914.
- — — On the photographic arc-spectrum of electrolytic iron. On the photographic arc-spectrum of iron meteorites. *Phil. Trans.* 185 (1895) 983-1023, 1023-1029.
- — — Observations of sun-spot spectra. (The broadening of the iron lines and of unknown lines in connection with the Sun-Spot periods.) *Nature* 51 (1895) 448-449; *Beibl.* (1896) 33.
- — — The new gas obtained from Uraninite. *Proc. Roy. Soc.* 57 (1895) 67-71, 113-120; 58 (1895) 192, 193-195; 59 (1896) 4-9, 342-343; *Beibl.* (1896) 775.
- — — The photographic spectrum of  $\gamma$  Cassiopeiae. *Proc. Roy. Soc.* 57 (1895) 173-177.
- — — Terrestrial Helium (?) *Nature* 51 (1895) 586.
- — — The shifting of spectral lines. *Nature* 53 (1895) 415-417.
- — — L'analyse spectrale des gaz dégagés par les divers minéraux. *C. R.* 120 (1895) 1103-1105; *Beibl.* (1895) 566.
- — — On the gases obtained from the mineral Eliasite. *Proc. Roy. Soc.* 59 (1895) 1-4; *Chem. News* 72 (1895) 283.
- — — The variable stars of the  $\delta$  Cephei Class. *Proc. Roy. Soc.* 59 (1895) 9, 101-106; *Beibl.* (1896) 700.
- — — The new gas obtained from Uraninite. Remarks on Messrs. Runge and Paschen's Diffusion Experiment. *Proc. Roy. Soc.* 59 (1896) 342-343; *Beibl.* (1896) 775.
- — — Total Eclipse of the Sun, April 16, 1893. *Phil. Trans.* 187 (1896) 551-618; *Astron. Nachr.* 140 (1896) 359-360; *Astrophys. J.* 4 (1896) 81; 5 (1896) 220-226.

- Lockyer. J. N. (Cont'd).* The unknown lines in the spectra of certain minerals. *Proc. Roy. Soc.* 60 (1896) 133-140.
- . Preliminary report on the results with the prismatic camera during the eclipse of 1896. *Proc. Roy. Soc.* 60 (1896) 271-272.
- . The story of Helium. *Nature* 53 (1896) 319-322, 342-346.
- . The total eclipse of the Sun. *Nature* 54 (1896) 197-199, 395-400, 418-421, 441-445.
- . Mars as seen at the Opposition in 1894. *Nature* 54 (1896) 625-627.
- . The Sun's place in Nature. *Nature* 57 (1896) 156-158, 204-207, 374-377, 396-399, 565-567; 58 (1896) 12-14.
- . Celestial eddies. *Nature* 55 (1897) 249-253.
- . Carbon in bright-line stars. *Nature* 55 (1897) 304-305, 341-342.
- . The iron lines present in the hottest stars, preliminary note. *Proc. Roy. Soc.* 60 (1897) 475-476; *Astron. Nachr.* 143 (1897) 59-61.
- . The chemistry of the hottest stars. *Proc. Roy. Soc.* 61 (1897) 148-209; *Nature* 56 (1897) 91-92.
- . Further observations on enhanced lines. *Proc. Roy. Soc.* 61 (1897) 441-444; *Beibl.* (1897) 975.
- . On the appearance of the Cleveite and other new gas lines in the hottest stars. *Proc. Roy. Soc.* 62 (1897) 52-67.
- . The present standpoint in spectrum analysis. *Nature* 59 (1898) 585.
- . The spectrum of the Corona. *Nature* 59 (1898) 279-280.
- . The Chemistry of the Stars. *Chem. News* 78 (1898) 233-235.
- . A simple spectroscope and its teachings. *Nature* 59 (1898) 371-374, 391-393; *Beibl.* (1899) 554.
- . The order of appearance of chemical substances at different stellar temperatures. *Chem. News* 79 (1899) 145-147; *Beibl.* (1899) 792.
- . The chemical classification of the stars. *Nature* 60 (1899) 52-54.
- . Some recent advances in spectrum analysis relating to inorganic and organic evolution. *Nature* 60 (1899) 103-108.
- . Preliminary note on the spectrum of the Corona. *Proc. Roy. Soc.* 64 (1899) 168-170.

- Lockyer, J. N.* The enhanced lines in the spectrum of  $\alpha$  Cygni. *Proc. Roy. Soc.* 64 (1899) 320-322; *Beibl.* (1899) 361.
- Lockyer, W. J. S.* The Evolution of Stellar Systems. *Nature* 56 (1897) 395-396.
- Lodge, O. J.* An experiment on the velocity of light in the neighborhood of rapidly moving matter. *Rept. Brit. Assoc.* (1891) 560; *Beibl.* (1892) 604.
- . Further progress in radiography. *Electrician* 36 (1896) 783-785.
- . On the question of absolute velocity and on the mechanical function of an ether, with some remarks on the pressure of radiation. *Phil. Mag.* (5) 46 (1898) 414-426.
- Lohse, O.* Eine Beschreibung der im Bereiche der Sonne zu beobachtenden Körper. Leipzig: Weber, 1894, 192 pp.
- . Untersuchung des violetten Teiles einiger linienreicher Metallspectra. *Sitzb. Berliner Akad.* (1897) 179-197; *Astrophys. J.* 6 (1897) 95-118; *Beibl.* (1898) 35.
- Lommel, E.* Ueber Phosphorescenz. *Sitzb. Muencher Akad.* (1886) 283-298; *Ann. Phys. n. F.* 30 (1887) 473-487.
- . Phosphorescenz von verschiedenen Schwefelcalcium- und Schwefelstrontium-Präparaten. *Ann. Phys. n. F.* 30 (1887) 47.
- . Die Photometrie der diffusen Zurückwerfung. *Sitzb. Münchener Akad.* (1887) 95-132; *Ann. Phys. n. F.* 36 (1889) 473-502.
- . Subjective Interferenzstreifen im objectiven Spectrum. *Sitzb. Münchener Akad.* (1888) 319-320.
- . Interferenz durch circulare Doppelbrechung. *Sitzb. Münchener Akad.* (1888) 325-336; *Ann. Phys. n. F.* 36 (1889) 733-743.
- . Phosphoro-Photographie des ultra-rothen Spectrums. *Sitzb. Münchener Akad.* (1888) 397-403; (1889) 83-87.
- . Selbstschatten einer Flamme. *Sitzb. Münchener Akad.* 20 (1889) 5-10.
- . Sichtbare Darstellung der Aequipotentialen Linien in durchsichtigen Platten. Erklärung des Hall'schen Phänomens. *Sitzb. Münchener Akad.* 22 (1892) 371-376.
- . Objective Darstellung von Interferenzerscheinungen in Spectralfarben. *Ann. Phys. n. F.* 50 (1893) 325.
- . Verbreiterung der Spectrallinien, kontinuierliches Spectrum, Dämpfungsconstante. *Ann. Phys. n. F.* 56 (1895) 741-745.

- Lommel, E. (Cont'd).* Theorie der Dämmerungsfarben. Abhandl. d. bayer. Akad. 19 II (1897) 1-60; Beibl. (1898) 568.
- —. Ueber aus Kalkspat und Glas zusammengesetzte Nicol'sche Prismen. Sitzb. Muenchener Akad. 28 (1898) 111-116 —See Leiss, Ztsch. f. Instrum. 17 (1897) 321, 357; Beibl. (1898) 404.
- Lord, H. C.* Curvature of the spectral lines. Astrophys. J. 5 (1897) 348-350.
- —. Some observations on stellar motions in the line of sight made at the Emerson McMillin Observatory, Columbus, O. Astrophys. J. 8 (1898) 65-69.
- —. On a graphic method of comparing the relative efficiencies of different spectroscopes. Astrophys. J. 9 (1899) 191-203.
- Lorentz, H. A.* Die Brechung des Lichtes durch Metallprismen. Ann. Phys. n. F. 46 (1892) 244.
- —. Das Gleichgewicht der Wärmestrahlen bei doppelbrechenden Körpern. Beibl. (1897) 29.
- —. Het theorema van het licht. Versl. k. Akad. Amsterdam 4 (1896) 176-187.
- —. Considerations concerning the influence of a magnetic field on the radiation of light. Astrophys. J. 9 (1899) 37-46, from Versl. Akad. Amsterdam, 25 Juni, 1898.
- —. Betrachtungen über den Einfluss eines Magnetfeldes auf die Emission des Lichts. Beibl. (1899) 49-51.
- —. Optische Erscheinungen, die mit der Ladung und der Masse der Ionen zusammenhängen. Beibl. (1889) 51-53.
- —. De elementaire theorie van verschijnsel van Zeeman. Antwoord op eene bedenking van Poincaré [accompanied by an English translation]. Versl. Akad. Amsterdam (1899) 69-86.
- Lorentzen, G.* Die Untersuchung der Scalen eines Helometers. Astron. Nachr. 131 (1892) 217-238; 135 (1894) 353-366.
- Love, A. E. H.* Fourier's Lines. Nature 58 (1898) 569-570.
- Love, E. F. J.* Method of distinguishing the real from the accidental coincidence of two lines of different spectra, with some applications. Phil. Mag. (5) 25 (1888) 1-6, Beibl. (1888) 348.
- Löwe, K. F.* Experimental-Untersuchung über elektrische Dispersion einiger organischer Säuren, Ester und von zehn Gläsern. Ann. Phys. n. F. 66 (1898) 390-410, 582-596.
- Lowell, P.* Evidence of a twilight arc upon the planet Mars. Nature 52 (1895) 401-405.



- Lowell, P.* Atmosphere in its effects on astronomical research. Rept. Brit. Assoc. (1897) 585.
- Lowenherz, L.* Die Anlauffarben des Stahls. Ztsch. f. Instrum. 9 (1889) 316-337.
- Lowenherz, R.* Molekularrefraction stickstoffhaltiger Substanzen. Ber. chem. Ges. 23 (1890) 2180.
- Lowy et Puiseux.* Sur la constitution et l'histoire de l'écorce lunaire. C.-R. 122 (1896) 967-973.
- Recherches sur l'aberration et sur la réfraction. C.-R. 122 (1896) 1157-1159.
- Lugol, P.* Elementare Ableitung des Minimums der Ablenkung im Prisma. J. de phys. (3) 6 (1897) 21-23; Beibl. (1897) 861.
- Lumière, A. et L.* Application de la photographie à la mesure des indices de réfraction. C.-R. 124 (1897) 1438-1440; Beibl. (1897) 965.
- Les actions de la lumière aux très basses températures. C.-R. 128 (1899) 359-361.
- Influence des températures très basses sur la phosphorescence. C.-R. 128 (1899) 549-552.
- Lummer, O., und E. Brodhun.* Photometrische Untersuchungen. Ztsch. f. Instrum. 9 (1889) 23-25, 41-50, 461-465; Beibl. (1889) 674-676.
- und *F. Kurlbaum.* Bolometrische Untersuchungen. Ann. Phys. n. F. 46 (1892) 204.
- u —. Bolometrische Untersuchungen für eine Lichteinheit. Sitzb. Berliner Akad. (1894) 229-238; Beibl. (1895) 492.
- Die Strahlung des absolut schwarzen Körpers und seine Verwirklichung. Naturwiss. Rundschau II (1896) 65-68, 81-83, 93-95; Beibl. (1896) 688.
- und *E. Brodhun.* Photometrische Untersuchungen. Ztsch. f. Instrum. 16 (1896) 299-307; Beibl. (1897) 127.
- Granglut und Rotglut. Ann. Phys. n. F. 62 (1897) 14-29.
- und *E. Pringsheim.* Die Strahlung eines "schwarzen" Körpers zwischen 100° und 1300° C. Ann. Phys. n. F. 63 (1897) 395.
- Herstellung absolut schwarzer Bolometer. Ztsch. f. Instrum. 18 (1898) 144; Beibl. (1898) 665.
- Die Verteilung der Energie im Spectrum des schwarzen Körpers. Verhandl. d. deutsch. phys. Ges. 1 (1899) 23-41.
- Lundström, C. J.* Flame spectra observed at Swedish Bessemer works. Proc. Roy. Soc. 59 (1896) 76-98; Beibl. (1896) 367.

- Lupke, R.* Einige Versuche über Lichtabsorption mittels des Heintz'schen Lampenofens. *Ztsch. phys, u. chem. Unterr.* 6 (1893) 288-290.
- Lussana, S.* Descrizione di un apparecchio semplice che serve a dimostrare le leggi relative alle radiazioni calorifica. *Beibl.* (1898) 665.
- Lynn, W. T.* The color of Sirius in Ancient Times. *Astrophys. J.* 1 (1895) 351.
- . The Constitution of Saturn's Rings. *Observatory* 18 (1895) 235.
- . Early observations of the Zodiacal Light. *Observatory* 19 (1896) 274-275.
- . Early observations of the Solar Corona. *Observatory* 19 (1896) 332-334.

## M

- Macaluso, D., e O. M. Corbino.* Sopra una nuova azione che la luce subisce attraversando alcuni vapori metallici in un campo magnetico. *Nuov. Cim.* 8 (1898) 257-259; *C.-R.* 127 (1898) 548-551, 951-953.
- , ———. Sulle modificazioni che la luce subisce attraversando alcuni vapori metallici in un campo magnetico. *Rend. Accad. Roma* 8 (1899) 38-41; *Nuov. Cim.* 9 (1899) 381-384.
- , ———. Sulla relazione tra il fenomeno di Zeeman e la rotazione magnetica anomala del piano di polarizzazione della luce. *Rend. Accad. Roma* 8 (1899) 116-120; *Nuov. Cim.* 9 (1899) 384-389.
- MacClean, F.* Photographies des spectres. *Séances Soc. fr. de phys.* (1892) 165-166; *Beibl.* (1894) 568.
- . Photographic stellar spectra of the variable star  $\beta$  Lyrae, and also of Types III and IV. *Mon. Not.* 57 (1896) 6-8.
- . Spectra of Southern Stars. London: E. Stanford, 1898; *Beibl.* (1899) 394.
- . Comparison of Oxygen with the extra lines in the spectra of the Helium stars,  $\beta$  Crucis, etc.; also Summary of the spectra of Southern Stars to the  $3\frac{1}{2}$  magnitude and their distribution. *Proc. Roy. Soc.* 62 (1898) 417-423; *Astrophys J.* 7 (1898) 367-372.
- McClelland, J. H.* Selective absorption of Röntgen rays. *Proc. Roy. Soc.* 60 (1896) 146-148.



- McConnel, J.* On diffraction colours, with special reference to corona and iridescent clouds. *Phil. Mag.* (5) 27 (1889) 272-289; 29 (1890) 167-173; Beibl (1890) 520.
- McCowan, J.* On ridge lines and lines connected with them. *Phil. Mag.* (5) 37 (1894) 227-237.
- Macdonald, J. D.* Analogy of Sound and Colour . . . as determined by the wave-lengths of colour and sound. *Proc. Roy. Soc.* 52 (1892-1893) 375.
- McDonall, F. K.* An appliance for direct comparison of star colors. *Jour. B. A. A.* 5 (1895) 517-519.
- MacDowell, Alex. B.* Sonnenflecken und Luft-Temperatur. *Meteorolog. Ztsch.* 14 (1897) 278.
- MacGowan, G.* Helium, together with a few notes on Argon. *Knowledge* 18 (1895) 210-213.
- MacGregor, J. G.* The variation with temperature and concentration of the absorption spectra of aqueous solutions of salts. *Trans. Roy. Soc. Canada Sec III* (1891) 27-41; Beibl (1893) 123.
- — —. The relation of the physical properties of aqueous solutions to their state of ionization. *Phil. Mag.* (5) 43 (1897) 99-100.
- Mach, E., und Arbes, J.* Totale Reflexion und anomale Dispersion. *Ann. Phys. n. F.* 27 (1886) 346.
- — — und *L. Mach.* Weitere ballistisch-photographische Versuche. *Sitzb. Wiener Akad.* 98 (1889) 1310-1326.
- — —, — — —. Longitudinale fortschreitende Wellen im Glase. *Sitzb. Wiener Akad.* 98 II (1889) 1327-1332.
- — —. Die Interferenz der Schallwellen von grosser Excursion. *Sitzb. Wiener Akad.* 98 (1889) 1333-1336.
- — —. Photographie de l'onde aerienne. *Séances Soc. fr. de phys.* (1893) 283-284.
- Mach, L.* Ein Interferenzrefractometer. *Sitzb. Wiener Akad.* 101 II (1892) 5-10, Beibl (1893) 834; (1894) 673.
- — —. Optische Untersuchungen. *Wiener Anzeiger* (1893) 198-200.
- — —. Optische Untersuchung der Luftstrahlen. *Wiener Anzeiger* (1897) 209.
- — —. Einige Verbesserungen der Interferenzapparaten. *Sitzb. Wiener Akad.* 107 II (1898) 851-859.
- McKissick, A. F.* Becquerel Rays. *Scientif. Amer.* (1897) 17542.
- McLeod, H.* Schuller's Yellow Modification of Arsenic. *Rept. Brit. Assoc.* (1894) 615; *Chem. News* 70 (1894) 139.

- Madan, H. G.* Note on some organic substances with high refractive power. *Phil. Mag.* (5) 21 (1886) 245. [Gives the refractive-index of the yellow sodium line for Naphtylphenylekton at 1,666; for m-Cinnamol (m-Styrol) at 1,593, for Monobrom-naphtalin at 1,662.]
- — —. Some organic liquids of high refractive power. *Beibl.* (1898) 769.
- Magnanini, G.* Sullo spettro di assorbimento del cloruro di nitrosile. *Rend. Accad. Roma* (4) 5 a (1880) 908-912. *Beibl.* (1890) 118
- — —. Applicazione del metodo fotometrico allo studio della reazione fra i sali ferrici ed i solfocianati solubili. *Rend. Accad. Roma* 7 (1891) 104 112
- — —. Absorptionsvermögen der gefärbten Salze in Bezug auf die electrolytische Dissociation. *Rend. Accad. Lincei* 7 (1891) 356-363; *Beibl.* (1892) 427.
- — —. Die Hypothese der Färbung der Ionen. *Rend. Accad. Roma* (5) 2 (1893) 369-376; 4 (1895) 60-63; *Beibl.* (1893) 827; (1895) 887.
- — — e *T. Bentivoglio.* Al spettro di assorbimento delle soluzioni di alcuni cromoossolati della serie bleu. *Rend. Accad. Roma* (5) 2 (1893) 17-23; *Beibl.* (1893) 926.
- — —. Das Absorptionsspectrum einiger Chromsulfocyanate. *Gazz. chim. ital.* 25 (1895) 373-379; *Beibl.* (1896) 695.
- Maier, M.* Beugungsversuch und Wellenlangenbestimmung der Röntgenstrahlen. *Ann. Phys. n. F.* 68 (1899) 903-916.
- Majorana, Q.* Azione di un raggio luminoso periodicamente interrotto sul selenio. *Atti Accad. Roma* 5 (1896) 45-52; *Nuov. Cim.* 4 (1896) 21.
- Malagoli, R.* e *C. Bonacini.* Sulla riflessione dei raggi di Rontgen. *Atti Accad. Lincei* 5 (1896) 327-331; *Nuov. Cim.* (4) 3 (1896) 307-309.
- — —. Sulla diffusione dei raggi Röntgen. *Rend. Accad. Lincei Roma* 7 I (1898) 96-104; *Nuov. Cim.* (4) 7 (1898) 263-270.
- — —. Sul comportamento dei corpi nella trasformazione dei raggi Röntgen. *Nuov. Cim.* (4) 9 (1899) 279 295.
- Mallard et Le Chatellier.* La variation qu'éprouvent, avec la température, les biréfringences du quartz, de la barytine et du disthène. *Ann. chim. phys.* (6) 6 (1895) 90-115.
- Maltezos, C.* Sur les rayons X. *C.-R.* 122 (1896) 1474-1476
- — —. Sur les rayons limités ( $\lambda - 0$ ). *C.-R.* 122 (1896) 1533-1534.

- Maltezos, O.* Sur une système phosphorescent antianodique et les rayons anodiques. C.-R. 124 (1897) 1147-1148.
- Mann, C. R.* The Echelon Spectroscope invented by Prof. Albert Michelson, a great improvement on the Rowland gratings. Science 8 (1898) 208-210.
- Marchand, E.* Relations des phénomènes solaires et des perturbations du magnétisme terrestre. Mém. couronn. Acad. Lyon; Beibl. (1889) 683.
- . Observations de la lumière zodiacale. C.-R. 121 (1895) 1134-1136.
- Markwick, E. E.* Some suspected variable stars of the Algol type. Observatory (1890) 178-179; Beibl. (1890) 983.
- . Observations of the variable star R. R. Sagittarii. Eng. Mech. 62 (1895) 289.
- . Observations of variable stars, Gibraltar, 1895. Eng. Mech. 62 (1895) 425-426.
- . Notes on the variable stars X and W Sagittarii. Mon. Not. 55 (1895) 338-341.
- . Note on the variable star T Centauri, Cord. G. C. 18609. Astron. Nachr. 138 (1895) 213-214; Mon. Not. 56 (1895) 35-38.
- . Observations of the Zodiacal Light. Jour. B. A. A. 5 (1895) 419.
- . Variable stars W, X, and Y Sagittarii. Mon. Not. 56 (1896) 381-388.
- . Variable star S Sculptoris. Astron. Nachr. 140 (1896) 94-95.
- Marx, E.* Zur Kenntniss der Dispersion im electrischen Spektrum des Wassers. Ann. Phys. n. F. 66 (1898) 411-434, 598-622.
- Mascari, A.* Protuberanze solari osservate nel R. Osserv. di Catania 1894. Mem. Spettr. Ital. 24 (1895) 61-79.
- . Sulla frequenza delle macchie solari osservate nel R. Osserv. di Catania 1895. Mem. Spettr. Ital. 24 (1895) 97-102.
- . Résumé of solar observations made in 1894 at the astrophysical observatory in Catania. Astrophys. J. 2 (1895) 119-126; Beibl. (1896) 198.
- . Résumé of solar observations made at Catania in 1895. Astrophys. J. 4 (1896) 205-211.
- . Sullo allargamento e sdoppiamento delle righe dello spettro solare dovuto alle condizioni meteorologiche dell'atmosfera. Mem. Spettr. Ital. 27 (1898) 81-90.

- Mascari, A* (Contd). Sulla frequenza e distribuzione in latitudine delle macchie solari osservate nell' Osserv. di Catania nel 1897. Mem. Spettr. Ital. 27 (1898) 135-152.
- —. Sulla frequenza e distribuzione in latitudine delle macchie solari osservate al R. Osserv. di Catania nel 1898. Mem. Spettr. Ital. 28 (1899) 31-35.
- —. Nota sopra la nota del P. Fényi, sopra la grande macchia. Mem. Spettr. Ital. 28 (1899) 111.
- Mascart*. L'achromatisme des interférences. Compt. rend 108 (1889) 591-597; Beibl. (1889) 693.
- —. Traité d'Optique. Paris: Gauthier-Villars, I (1889) 638 pp., I (1891) 643 pp., III (1893) 696 pp.
- et *Bouasse*. La photographie des franges des cristaux. C.-R. 111 (1890) 83-84; Beibl. (1890) 905.
- —. Le retard des impressions lumineuses. C.-R. 113 (1891) 180.
- —. L'aberration. C.-R. 113 (1891) 571-573; Beibl. (1893) 28.
- —. L'arc-en-ciel blanc. C.-R. 115 (1892) 429-435, 453-455.
- —. L'achromatisme des interférences. Soc. franç. de phys. (1892) 4-5, 500-516; (1893) 18-25; Beibl. (1893) 836.
- Matthiessen, E*. Einfluss des Procentgehaltes und der Temperatur auf das Brechungsvermögen vom reinen Zuckerlösungen. Diss. Rostock 1898. 34 pp. Beibl. (1898) 557.
- Matthiessen, L*. Die Phoronomie der Lichtstrahlen in anisotropen, unkrystallinischen Medien im allgemeinen und in sphärischen Niveauflächen im besonderen. Repert. d. Phys. 25 (1889) 663-684.
- Maunder, E. W.* Report of the Section for the observation of Mars. Mem. B. A. A., 2 part 6 (1895) 157-198.
- — —. The Great Nebula. Knowledge 18 (1895) 156-157.
- — —. Dark "Lanes" of the Milky Way. Knowl. 18 (1895) 36-38.
- — —. Dr. Roberts's photographs of star-clusters and nebulae. Knowledge 18 (1895) 155.
- — —. What is a nebula? Knowl. 18 (1895) 253.
- — —. The objective prism and the motions of stars in the line of sight. Observ. 19 (1896) 84-86; Astrophys. J. 3 (1896) 311-313.
- — —. Helium and Parhelium. Knowl. 19 (1896) 284-287.
- — —. Chemistry of the stars. Observ. 20 (1897) 98-99.
- — —. Nebula round  $\eta$  Argus. Knowl. 20 (1897) 120-122.

- Maunder, E. W.* Aristarchus and the Sinus Iridum. *Knowl.* 20 (1897) 142-144.
- Maurer, J.* Die atmosphärische Absorption von strahlender Wärme niedriger Temperatur und die Grosse der Sternenstrahlung. *Repert. d. Phys.* 25 (1889) 642-654; *Beibl.* (1890) 375.
- . Zur Frage der Sternenstrahlung. *Meteorol. Ztschr.* 7 (1890) 18-25.
- . Das Phosphoresciren der Gletscher. *Meteorol. Ztschr.* 15 (1898) 108-109; *Beibl.* (1898) 402.
- . Erscheinungen des Erdlichtes, 1895-1899. *Meteorol. Ztschr.* 16 (1899) 257-260; *Beibl.* (1899) 637.
- Mauzy, Antonia C.* Die Spektra der hellen Sterne. *Naturwiss. Rundsch.* 12 (1897) 581-583.
- . The K lines of  $\beta$  Aurigae. Harvard Conference, Aug. 20, 1898; *Astrophys. J.* 8 (1898) 173-175.
- Mayberry, F., and E. J. Hudson.* Refractive power of the hydrocarbons and chlorine derivatives. *Amer. Chem. J.* 19 (1897) 482-484.
- Mayer, Alfred A.* Studies of the phenomena of simultaneous contrast colour; and on a photometer for measuring the intensities of lights of different colours. *Amer. J. Sci.* (3) 31 (1893) 1-22; *Phil. Mag.* (5) 36 (1893) 153-175.
- Mazzotto, D.* Indice di rifrazione nell' acqua per onde elettriche da 2 m. a 25 cm. di lunghezza. *Nuov. Cim.* 5 (1897) 55-57.
- Mebius, C. A.* Galitzin's Theorie der Ausbreitung der Spektrallinien. *Oefvers. Akad. Stockholm* 55 (1898) 485-495; *Beibl.* (1899) 419.
- Melander, G.* Ein Spektrometer zur directen Unterscheidung der tellurischen Linien im Sonnenspektrum. *Finska Vet. Forh.* 39 (1897) 247-255; *Beibl.* (1899) 178.
- . Un prisme à angle variable. *Ofvers. Finska Forh.* 40 (1898) 4 pp.
- Mendenhall, C. E., and F. A. Saunders.* Preliminary note on the energy-spectrum of a black body. *Phil. Mag.* (5) 44 (1897) 136.
- . The energy-spectrum of an absolutely black body. *Johns Hopkins Univ. Cir.* 17 (1898) 55; *Beibl.* (1898) 770.
- Mengarini, G.* Il massimo d'intensità luminosa dello spettro solare, I et II. *Atti Accad. Roma* 3 (1887) 482-489, 566-573; *Jahresb.* (1887) 342.
- Mercanton, P. L.* La phosphorescence des glaciers et des neiges. *Bull. Soc. Vaudoise* 34 (1898) 231-240; *Beibl.* (1898) 778.



- Merino, M.* Sur le bolide du 10 février 1896. C.-R. 122 (1896) 683; Astron. Nachr. 140 (1896) 169.
- Merkelbach, W.* Zur Absorption des Lichtes durch Natriumdampf. Ztsch. phys. u. chem. Unterr. 5 (1892) 253-254; Beibl. (1893) 564.
- Merritt, E.* The absorption of certain crystals in the infra-red as dependent on the direction of the plane of polarization. Phys. Rev. 2 (1895) 424-442; Beibl. (1895) 694.
- Meslin, G.* Sur les franges d'interférence semi-circulaires. C.-R. 116 (1893) 350-353, 377-379, 379-383, 570-572; Beibl. (1894) 198-199.
- Les nouvelles franges d'interférence rigoureusement achromatiques. C.-R. 117 (1893) 225-228; Beibl. (1894) 199, 568.
- Les alternances de couleurs présentées par les réseaux. C.-R. 117 (1893) 339-342; Beibl. (1894) 570.
- Les franges de l'ouverture, dans l'expérience des réseaux parallèles. C.-R. 117 (1893) 482-485.
- Mémoire sur les franges d'interférences rigoureusement achromatiques et sur la constitution des ondes paragéniques. Ann. chim. phys. (6) 2 (1894) 362-408; Beibl. (1895) 500.
- La constitution des ondes paragéniques de diffraction. C.-R. 118 (1894) 853-856; Beibl. (1894) 1001.
- Un photomètre relatif aux rayons X permettant d'explorer le champ de ces rayons. J. de phys. 5 (1896) 202-204.
- Messerschmitt, J. B.* Diffuse Reflexion. Ann. Phys. n. F. 34 (1888) 867-897.
- Zur Photometrie der Himmelskörper. Beibl. (1891) 108.
- Mewes, R.* Emission und Absorption. Ann. Phys. n. F. 46 (1892) 171.
- Zur Theorie der Gase auf Grund der Sellmeier'schen Absorptionstheorie. Ztsch. f. komprimierte und flüssige Gase 1 (1897) 90-94, (1898) 136-142, 164-166; Beibl. (1898) 144.
- Meyer, G.* Brechungsexponenten des Eises. Ann. Phys. n. F. 31 (1887) 321.
- Meyer, Lothar.* Die Zerlegung der Phenyläthylbrompropionsäure in ihre optisch-activen Modificationen. Ber. chem. Ges. 25 (1892) 3121-3123.
- Nachtrag zu A. Weigle: Spectrophotometrische Untersuchungen der Salze aromatischer Basen. Ztsch. phys. Chem. (3) 11 (1893) 426-428.

- Meyer, R.* Einige Beziehungen zwischen Fluorescenz und chemischer Konstitution. Ztsch. phys. Chem. 24 (1897) 468-508; Beibl. (1898) 401.
- Meyers, G. W.* Lichtwechsel des Sternes  $\beta$  Lyrae. Diss. Munchen 1896, 64 pp., mit 5 Fig.
- — — The System of  $\beta$  Lyrae. Astrophys. J. 7 (1898) 1-22.
- Michaelis, A.* Zur Kenntniss der Chloride des Tellurs. Ber. chem. Ges. 20 (1887) 2488-2492; Beibl. (1887) 778.
- Michelson, A. A., and E. W. Morley.* On a method of making the wave-length of sodium light the actual and practical standard of length. Phil. Mag. (5) 24 (1887) 463-466; Amer. J. Sci. (3) 34 (1887) 427-430; Jahresb. (1887) 336.
- — — Versuch einer theoretischen Erklärung der Energievertheilung in den Spectren fester Körper. J. russ. phys. chem. Ges. (4) 19 (1887) 79-99; J. de phys. 6 (1887) 467-479; Phil. Mag. (5) 25 (1888) 425-435; Beibl. (1888) 658-661.
- — — A plea for light waves. Proc. Amer. Assoc. (1888) 14 pp.; Beibl. (1889) 496.
- — — and *E. W. Morley.* Feasibility of establishing a light-wave as the ultimate standard of light. Amer. J. Sci. (3) 37 (1889) 181-186; Beibl. (1890) 6.
- — — Moderne Untersuchungen über die Theorie der continuirlichen Spectra. J. russ. phys. chem. Ges. (6) 21 (1889) 87-103; Beibl. (1890) 277.
- — — A simple interference experiment. Amer. J. Sci. (3) 39 (1890) 216-218; Beibl. (1890) 803.
- — — The application of interference methods to spectroscopic measurements. Phil. Mag. (5) 30 (1890) 1-21; 31 (1891) 338-346; 34 (1892) 280-299; Smithsonian Contributions to Knowledge No. 842 (1892) 24 pp.; Beibl. (1890) 804; (1894) 85.
- — — Visibility of interference-fringes in the focus of a telescope. Phil. Mag. (5) 31 (1891) 256-259; Beibl. (1891) 521.
- — — Comparaison du metre international avec la longueur d'onde de la lumière du cadmium. C.-R. 116 (1893) 790-794; Beibl. (1894) 625.
- — — Appareils interférentiels dans la météorologie et l'établissement d'une longueur d'onde comme unité absolue de longueur. Soc. franç. de phys. (1893) 3-5, 155-172.
- — — Light-waves and their application to Meteorology. Nature 49 (1893) 56-60.

- Michelson, A. A. (Cont'd).* Les méthodes interférentielles en métrologie et l'établissement d'une longueur d'onde comme unité absolue de longueur. *J. de phys.* (3) 3 (1894) 5-22.—See Koch, *Ann. Phys. n. F.* 52 (1894) 432.
- . On the conditions, which influence the spectrophotography of the Sun. *Astrophys. J.* 1 (1895) 1-9; *Beibl.* (1898) 428.
- . On the limit of visibility of fine lines in a telescope. *Astrophys. J.* 1 (1895) 60-62; *Beibl.* (1896) 25.
- . On the broadening of spectral lines. *Astrophys. J.* 2 (1895) 251-263; *Beibl.* (1896) 532.
- . Radiation in the Magnetic Field. *Astrophys. J.* 6 (1897) 48-54; 7 (1898) 131-139; *Beibl.* (1898) 350.
- . Relative motion of the Earth and the Ether. *Amer. J. Sci.* (4) 3 (1897) 475-479.
- and *W. W. Stratton.* A new harmonic analyser. *Phil. Mag.* (5) 45 (1898) 85-91; *Amer. J. Sci.* (4) 5 (1898) 1-4.
- . The Echelon Spectroscope. *Astrophys. J.* 8 (1898) 37-47.—See C.-R. Mann, *Sci.* 8 (1898) 208-210.
- . Fourier's Series. *Nature* 58 (1898) 545.
- Millosevich, E.* Sulle due comete scoperte il 17 e il 18 novembre in America. *Atti Accad. Roma* 4 (1895) 268-269.
- . Sulle prossime opposizioni del pianeta D Q 1898. *Mem. Spettr. Ital.* 27 (1898) 127.
- . Osservazioni della nuova cometa Perrine (1898, marzo 19). *Rend. Accad. Roma* 7 I (1898) 252-253.
- Mirat, S. B.* Analyse d'une des pierres météoriques tombées à Madrid le 10. février 1896. *C.-R.* 122 (1896) 1352.
- Mitchell, S. A.* Notes on the Concave-Grating. *Astrophys. J.* 8 (1898) 102-112; *Johns Hopkins Univ. Cir.* 17 (1898) 56-58.
- . The Direct Concave-Grating Spectroscope. *Astrophys. J.* 10 (1899) 29-39; *Beibl.* (1899) 773.
- Mixter, G. W.* Electro-Magnetic Waves. *Astrophys. J.* 5 (1897) 354-360.
- Mohler, J. F.* Note on the refractive index of water and alcohol for electrical waves. *Phys. Rev.* 4 (1896) 153-154.
- . Effect of pressure on wave-length. *Astrophys. J.* 4 (1898) 175-181.
- and *L. E. Jewell.* The wave-length of some of the helium lines in the vacuum tube and of D<sub>3</sub> in the Sun. *Astrophys. J.* (1896) 351-355.



- Mohler, J. F.* Pressure in the electric spark. *Astrophys. J.* 10 (1899) 202-206.
- Moissan, H.* Sur la couleur et sur le spectre du fluor. *C.-R.* 109 (1889) 937-940; *Jahresb.* (1889) 369.
- . Nouveaux recherches sur le fluor. *Ann. chim. phys.* (6) 24 (1891) 224-282; *Beibl.* (1892) 27.
- . Étude de quelques phénomènes nouveaux de fusion et de volatilisation produits au moyen de la chaleur de l'arcélectrique. *Bull. Soc. chim. Paris* 11-12 (1894) 822-828.
- . Nouvelles recherches sur le chrome. *C.-R.* 119 (1894) 185-191.
- . Action du fluor sur l'argon. *C.-R.* 120 (1895) 966-969.
- . Étude de quelques météorites. *C.-R.* 121 (1895) 483-486.
- . Étude sur l'argon. *Ann. chim. phys.* (7) 8 (1896) 141-144.
- . Préparation et propriétés de l'uranium. *C.-R.* 122 (1896) 1088-1093.
- et *Ch. Moureau.* Action de l'acétylène sur le fer, le nickel et le cobalt réduits par l'hydrogène. *C.-R.* 122 (1896) 1240-1243.
- . Fluorine. Read before Roy. Inst. Gr. Brit. May 28, 1897; *Beibl.* (1898) 268.
- et *H. Deslandres.* Recherches spectrales sur l'air atmosphérique. *C.-R.* 126 (1898) 1689-1691. (Made with the assistance of MM. Lebeau et F. Mittau. And the gas was believed to be not Krypton.)
- Moll, D. P.* Eine Interferenzerscheinung in Quarzfäden. *Beibl.* (1898) 36.
- Mouck, W. H. S.* Absorption of light in space. *Astron. and Astrophys.* 12 (1893) 33-37; *Beibl.* (1893) 831.
- . The spectra and proper motions of stars. *Astron. and Astrophys.* 12 (1893) 811-812.
- . The structure of the Universe. *Knowledge* 18 (1895) 38.
- . The spectra and proper motions of Southern stars. *Jour. B. A. A.* 5 (1895) 164.
- . The spectra and colors of double stars. *Jour. B. A. A.* 5 (1895) 416.
- . Some luminous appearances in the Sky. *Pub. A. S. Pac.* 9 (1896) 33-36.
- . The spectra and proper motions of stars. *Pub. A. S. Pac.* 9 (1897) 123-128; *Astrophys. J.* 8 (1898) 28-31.

- Moreau, G.* Dispersion rotatoire magnétique infra-rouge du sulfure de carbone. *Ann. chim. phys.* (7) 1 (1884) 227-259.
- —. De l'absorption de la lumière dans les milieux isotropes et cristallisés. *C.-R.* 119 (1894) 327-329; *Beibl.* (1894) 1044.
- —. De la périodicité des raies d'absorption des corps isotropes. *C.-R.* 119 (1894) 422-425; *Beibl.* (1895) 494.
- —. Sur la dispersion rotatoire des milieux absorbants cristallisés. *C.-R.* 120 (1895) 258.
- —. Absorption de la lumière dans les cristaux uniaxes. *C.-R.* 120 (1895) 602-605.
- Morera, G.* Sull' espressione analitica del principio di Huygens. *Nuov. Cim.* (4) 2 (1895) 17-26.
- Morize, H.* La durée de l'émission des rayons de Röntgen. *C.-R.* 127 (1898) 545-548.
- Morley, Ed. W., and W. Rogers.* The measurement of the expansion of metals by the interferential method. *Phys. Rev.* 4 (1896) 1-23, 106-127.
- Moses, A. F., und E. Weinschenk.* Eine einfache Vorrichtung zur Messung der Brechungsexponenten kleiner Krystalle mittels Totalreflexion. *Ztsch. Kryst. u. Min.* 26 (1896) 150-156.
- Mouchez.* Photographies spectrales d'étoiles de MM. Henry, de l'observatoire de Paris. *C.-R.* 111 (1890) 5-6; *Beibl.* (1890) 789.
- Moulton, F. R.* Theory of the determination of the elements of a parabolic orbit from two observations of apparent position, and one of the motion in the line of sight. *Astrophys. J.* 10 (1899) 14-21.
- Moureaux, C.* Sur la présence de l'argon et de l'hélium dans une source d'azote naturelle. *C.-R.* 121 (1895) 819-820.
- Mourelot, J. R.* Recherches sur le sulfure de strontium, et méthode pour l'obtenir très phosphorescent. *C.-R.* 124 (1897) 1024-1026, 1327-1329; *Beibl.* (1897) 634.
- — —. La couleur de la phosphorescence du sulfure de strontium. *C.-R.* 124 (1897) 1521-1523; 828 (1899) 557; *Beibl.* (1897) 741.
- — —. Sur l'obtention du sulfure de strontium au moyen du gaz sulfhydrique et de la strontiane ou carbonate de strontium. Influence de la température. *C.-R.* 125 (1897) 775-780.
- — —. Sur la décomposition de l'hyposulfite et du sulfite de strontium par la chaleur et la production du sulfure strontique phosphorescent. *C.-R.* 126 (1898) 420-423.

- Mourelle, J. R.* Sur les propriétés du sulfure de strontium phosphorescent. C.-R. 126 (1898) 904-906.
- . Sur les mélanges phosphorescents formés par le sulfure de strontium. C.-R. 126 (1898) 1508-1510.
- . La composition des sulfures de strontium phosphorescents. C.-R. 127 (1898) 229-232, 361-364, 372-374; Beibl. (1898) 847.
- . Le sulfure de strontium phosphorescent, préparé au moyen du carbonate de strontium et de la vapeur de soufre. C.-R. 128 (1899) 427-429; Beibl. (1899) 252.
- . Sur la phosphorescence du sulfure de strontium. C.-R. 128 (1899) 557-559.
- . Sur l'activité du manganèse par rapport à la phosphorescence du sulfure de strontium. C.-R. 128 (1899) 1239-1241.
- Muller, F. C. G.* Einfluss der Temperatur auf die Brechung des Lichtes an verschiedenen Prismen. Pub. astrophys. Observ. Potsdam 4 (1885) 151-216, Beibl. (1886) 279.
- . Der Satz vom Minimum der Ablenkung beim Prisma. Ztsch. phys. chem. Unterr. 3 (1890) 247-248.
- . Photometrische und spectroscopische Beobachtungen angestellt auf dem Gipfel des Säntis. Pub. astrophys. Observ. Potsdam 8 I (1891) 1-101; Beibl. (1893) 1063.
- . Helligkeitsbestimmungen der grossen Planeten und einiger Asteroiden. Naturwiss. Rundsch. 8 (1893) 458-460, 469-472.
- . Zur Absorption des Natriumlichts durch Natriumdampf. Ztsch. f. phys. chem. Unterr. 8 (1895) 95-96; Beibl. (1895) 635.
- . Eine neue Konstruktion des Uhrwerkheliostaten. Ztsch. phys. chem. Unterr. 8 (1895) 354-357.
- Muller, G.* Die Photometrie der Gestirne. Leipzig: Englemann, 1897, 556 pp. u. 81 Fig.; Astrophys. J. (1898) 311-315.
- u. *P. Kempf.* Die Absorption des Sternenlichtes in der Erdatmosphäre, angestellt auf dem Aetna und in Catania. Pub. Astrophys. Observ. Potsdam 11 (1898) 211 pp.; Beibl. (1898) 776; Mem. Spettr. Ital. 27 (1898) 51-66.
- . Photometrische Durchmusterung des nördlichen Himmels, enthaltend alle Sterne der B. D bis zur Grösse 7.5. Theil I, Zone 0° bis + 20 Declination, 4to., 501 pp., Potsdam 1894. Theil II, Zone + 20 bis + 40 Declination, 4to., 465 pp., Potsdam 1899. Astrophys. J. 10 (1899) 59-69, review by J. A. Parkhurst.

- Müller-Erbach, W.* Das Gesetz der Abnahme der Absorptionskraft bei zunehmender Dicke der absorbirten Schichten. Wiener Anzeiger (1889) 50-52, 327-339; Verh. deutsch. Naturf. u. Aerzte II 1 (1895) 70-72.
- . Neue Versuche über die Fernwirkung der Absorptionskraft und ihre Abnahme bei zunehmender Dicke der absorbirten Schichten. Wiener Anzeiger (1896) 112-113; Sitzb. Wiener Akad. 105 II a (1896) 263-289; Ann. Phys. n. F. 58 (1896) 736-758.
- Murphy, D. W.* Methode zur Prüfung der Fresnel'schen Formeln in ihrer Abhängigkeit vom Einfallswinkel und der Farbe des Lichts. Ann. Phys. n. F. 57 (1896) 593-603.
- . Spectrophotometric Studies. Astrophys. J. 6 (1897) 1-21; Beibl. (1898) 663.
- Muthmann, W.* Ueber den Schwefel und das Selen. Ztsch. Kryst. u. Min. 17 (1889) 336-367.
- Muynck, R. de.* Die Brechungsexponenten von wässerigen Cadmiumsalzlösungen. Ann. Phys. n. F. 53 (1894) 559-563.

## N

- Naegumvala, K. D.* Nebula No. 6595 of the New General Catalogue. Obs'y 18 (1895) 310-311.
- . Photograph of the spectrum of the "Flash" made at the eclipse of Jan. 21, 1898. Astrophys. J. 8 (1898) 121.
- Nagaoka, H.* Beugungserscheinungen durch eine Oeffnung in einer gekrümmten Oberfläche. Jour. Japan Coll. Sci. 4 II (1891) 301-322; Beibl. (1892) 29.
- . Ein Problem der Diffraction. Beibl. (1893) 1070.
- . A certain class of Fraunhofer's Diffraction Phenomena. Lines of about equal intensity about the point of intersection of Fraunhofer's Diffraction Bands. J. Coll. Sci. Japan 9 (1895) 13 pp.—See Cinelli, Nuov. Cim. (4) 1 (1895) 141-155; Beibl. (1895) 788.
- . Diffraction phenomena in the focal plane of a telescope with circular aperture, due to a finite source of light. Phil. Mag. (5) 45 (1898) 1-23.
- Nannes.* Absorption of Röntgenstrahlen i glas. Ofvers. K. Akad. Stockholm 53 (1896) 505-507.
- Nasini, R., et A. Scala.* Sulla rifrazione molecolare dei solfocianati, degli isosolfocianati e del thiophene. Atti Accad. Roma 2 (1886) 617-623; Beibl. (1886) 695; Gazz. chim. Ital. 17 (1887) 66, 72.

- Nasini, R.* Molekularrefraction organischer Substanzen. Gazz. chim. Ital. 17 (1887) 48, 55; Jahresb. (1887) 337.
- —. Theorien des Brechungsvermögens organischer Verbindungen, Bruhl gegenüber Gazz. chim. Ital. (1890) 1; Jahresb. (1890) 388.
- —. Analogia tra la materia allo stato gazzoso e quella allo stato di soluzione diluita. Gazz. chim. Ital. (1890) 190-220.
- —. Sulla dispersione dei composti organici. Rend. Accad. Roma (4) 6 a (1890) 211-215; Gazz. chim. Ital. (1890) 356; Jahresb. (1890) 356.
- — et *T. Costa* Brechungsindices einiger Derivate des Triethylsulfins. Rend. Accad. Roma (4) 6 b. (1890) 284; Jahresb. (1890) 389.
- —. Sull' impiego della dispersione per riconoscere i derivati allibenzolici da quelli propenilbenzolici. Rend. Accad. Roma (1890) 299-301.
- —. Sull' applicazione alla chimica ottica di alcune formule proposte dall' prof. Ketteler. Rend. Accad. Roma 6 (1890) 324-331.
- — e *T. Costa*. Ricerche sopra i derivati solfinici e loro confronto con le combinazioni degli ammonii organici. Rend. Accad. Roma 7 (1891) 623-631; Beibl. (1892) 146-148.
- —. Sulle variazioni del potere rifrangente e dispersione dello zolfo nei suoi composti. Reg. Univ. Roma, Ist. chim. 1891, 147 pp.; Beibl. (1893) 111.
- —. Sul potere rifrangente per un raggio di lunghezza d'onda infinita. Rend. Accad. Roma (5) 2 (1893) 162-166; Beibl. (1893) 739.
- — e *Anderlini*. Sul potere rifrangente dei composti continenti il carbonile. Rend. Accad. Roma (5) 3 (1894) 22-26, 49-59; Beibl. (1894) 665.
- — e *G. Carrara*. Sul potere rifrangente dell' ossigeno, dello zolfo e dell' azoto nei nuclei eterociclici. Gazz. chim. Ital. 24 (1894) 256-291; Beibl. (1894) 834.
- — e *Anderlini*. Sopra alcuni fatti relativi all' argon. Rend. Accad. Roma 4 (1895) 269-270; Chem. News 72 (1895) 247.
- — e *Salvadori*. Earthy Coronium. Chem. News 78 (1898) 43; Beibl. (1898) 842.
- —, — —, — —. Sopra alcune righe non mai osservate nella regione ultra rossa dello spettro dell' argo. Rend. Accad. Roma 8 II (1899) 269-270.

- Nebel, B.* Störende Einflüsse am Bunsen'schen Photometer und diesbezügliche Abänderungen. Rept. d. Phys. 24 (1888) 724-730; Beibl. (1889) 673.
- Neesen, F.* Erfahrungen an Röntgen-Strahlen. Verh. deutsch. Naturf. u. Aerzte II 1 (1897) 70-72.
- Neovius, O.* Die Trennung der Stickstoff- und Sauerstofflinien im Emissionsspectrum der Luft. Bih. Svensk. Akad. 17 I, no. 8 (1891) 69 pp.; Beibl. (1893) 563.
- . Om skiljandet af kräfvets och syrets linier i luftens emissions-spectrum. Bih. Svensk. Akad. Handl. 17 I (1892) 69 pp.; Beibl. (1893) 563.
- Neuhauss, R.* Ueber die Photographie in natürlichen Farben nach Lippmann's Verfahren und den Nachweiss der dünnen Zenker'schen Blättchen. Verh. d. phys. Ges. Berlin 17 (1898) 94-96; Beibl. (1898) 844.
- Newall, H. F.* Peculiarities observed in iron and steel at a bright-red heat. Phil. Mag. (5) 24 (1887) 435-439.
- . A diagram useful as a guide in adjusting a diffraction grating spectroscope. Mon. Not. 52 (1892) 509-512; Beibl. (1893) 129.
- . A combination of prisms for a stellar spectroscope. Proc. Phil. Soc. Cambridge 8 (1894) 138-141; Beibl. (1895) 328.
- . Note on the spectrum of Argon. Proc. Roy. Soc. 57 (1895) 346-351; Astrophys. J. 1 (1895) 372-376; Beibl. (1895) 567.
- . Description of a spectroscope (The Bruce Spectro-scope). Astrophys. J. 3 (1896) 266-280; Beibl. (1897) 335; Mon. Not. 56 (1896) 98-110; Proc. Phil. Soc. Cambridge, U. S. A. 9 (1896) 179-183.
- . Some spectroscopic determinations of velocity in the line of sight made at the Cambridge Observatory. Mon. Not. 57 (1897) 567-577.
- . Luminosity attending the compression of certain rarified gases. Proc. Cambridge Phil. Soc., U. S. A. 9 (1897) 295-303; Beibl. (1898) 172.
- Newth, G. S.* Note on the colours of the alkali metals. Nature 47 (1892) 55; Beibl. (1893) 335.
- and *H. E. Armstrong.* Flame. Nature 49 (1893-1894) 171.
- Nichols, E. L.* A spectro-photometric study of pigments. Amer. J. Sci. (3) 28 (1884) 342; Jahresb. (1884) 295.



- Nichols, E. L.* and *W. Franklin*. Spectrophotometric comparison of artificial sources of light. *Amer. J. Sci.* (3) 38 (1890) 100-114; Beibl. (1890) 39.
- and *B. W. Snow*. The influence of temperature on the colour of pigments. *Phil. Mag.* (5) 32 (1891) 401-424; Beibl. (1892) 361.
- , —. The character of the light emitted by incandescent zinc-oxid. *Phil. Mag.* (5) 33 (1892) 19-28; Beibl. (1892) 427.
- , —. The selective absorption of light by optical glass and feldspar. *Phil. Mag.* (5) 33 (1892) 379-381; Beibl. (1892) 608.
- , —. Age-coating in incandescent lamps. *Amer. J. Sci.* (3) 44 (1892) 277-286.
- , —. The transmission spectra of certain substances in the infra-red. *Phys. Rev.* 1 (1893) 1-18; Beibl. (1893) 1062.
- and *Mary L. Crehore*. Studies of the Lime Light. *Phys. Rev.* 2 (1894) 161-170; Beibl. (1895) 565.
- , —. A new form of spectrophotometer. *Phys. Rev.* 2 (1895) 138-141; Beibl. (1895) 241.
- , —. The distribution of energy in the spectrum of the Glow Lamp. *Phys. Rev.* 2 (1895) 260-276; Beibl. (1895) 783.
- , —. A method for the study of transmission spectra in the ultra-violet. *Phys. Rev.* 2 (1895) 298, 305; Beibl. (1895) 426.
- and *Mary C. Spencer*. The influence of temperature upon the transparency of solutions. *Phys. Rev.* 2 (1895) 344-360; Beibl. (1895) 493.
- , —. Das Verhalten des Quarzes gegen langwellige Strahlung untersucht nach der radiometrischen Methode. *Sitzb. Akad. Berlin* (1896) 1183-1196; *Phys. Rev.* (1897) 297-313.
- Niewenglowski, G. H.* Observations à propos d'une note récente de M. Le Bon sur la lumière noire. *C.-R.* 122 (1896) 232-233, 385.—See Le Bon, *ibid.* 188, 233, 386.
- , —. La photographie de l'invisible au moyen des rayons X ultra-violet, de la phosphorescence et de l'effluve électrique. Paris: Desforges, 1896, 23 pp.
- Noack, K.* Verzeichniss fluorescirender Substanzen nach der Farbe des Fluoreszenzlichtes geordnet mit Literaturnachweisen. *Ges. zur Beförd. d. Naturwiss. zu Marburg* 12 (1887) 2 e Abhandl., 155 pp.
- Robert, F. A.* Die Interferenzspectrumplatte. *Ann Phys.* 85 (1852) 80; *Phil. Mag.* (4) 1 (1852) 570; *Jahresb.* (1852) 134.

- Nodon* La photographie du spectre infra-rouge des rayons de Röntgen. Éclair. électr. 8 (1896) 321-322; C.-R. 122 (1896) 237; Paris: Perret et Cie, 1897, 22 pp.
- Nordenskiöld, A. E.* Ein einfaches Verhältniss zwischen den Wellenlängen der Spectra einiger Substanzen. Oefvers. Vet. Akad. Stockholm (1887) 471-478; Beibl. (1888) 527-528.
- Norwegian Polar Station.* Spectroscopic Researches at the. Nature 38 (1888) 515-516.
- Novak, V., und O. Suk.* Die Absorption von Röntgen's Strahlen durch chemische Verbindungen. Ztsch. phys. Chem. 19 (1896) 489-512.
- Nyland, A.* Beobachtungen an Mira Ceti. Astron. Nachr. 141 (1896) 419.

## O

- Oberbeck, A.* Die Absorption der Röntgen-Strahlen. Naturwiss. Rund 11 (1896) 265.
- Observatory (Editor of).* Algol. Observ. 18 (1895) 229-231.
- Offret, A.* De la variation, sous l'influence de la chaleur, des indices de réfraction de quelques especes minérales, dans l'étendue du spectre visible. Bull. Soc. min. France 13 (1890) 405-688; Beibl. (1891) 565.
- O'Gyalla Observatorium.* Astrophysikalischen Beobachtungen, 1887-1899.
- O'Halloran, Rose.* Observations of variable stars. Pub. A. S. Pac. 8 (1896) 254.
- . Mira Ceti (1895-1896). Pub. A. S. Pac. 8 (1896) 79-81.
- . Maximum of O Ceti, 1896-1897. Pub. A. S. Pac. 9 (1897) 86-109.
- Olsen, H.* Ein Gitterspektralapparat. Ztsch. f. Instrum. 18 (1898) 280-283.
- . Untersuchung des astrophotographischen Messapparates und Gitters der Sternwarte in Stockholm. Oefvers. Akad. Stockholm 55 (1898) 5-33.
- Olzewski, K.* Ueber das Absorptionsspektrum des flüssigen Sauerstoffs und der verflüssigten Luft. Sitzb. Wiener Akad. 95 11 (1887) 257-261; Ann. Phys. n. F. 33 (1888) 436, 570-575; Jahresb. (1888) 436.
- . Appareil pour liquifier et solidifier les gaz appelés permanents et pour étudier leur spectre d'absorption. Krakauer Anzeiger (1889) 28.



- Olszewski et, K. A. Wukowski.* Optische Eigenschaften des flüssigen Sauerstoffs. Bull. Acad. Cracovie (1891) 340-343; Beibl. (1894) 665.
- —. The liquefaction and solidification of Argon. Proc. Roy. Soc. 57 (1895) 290-293; Chem. News 71 (1895) 59-60.
- —. Ein Versuch das Helium zu verflüssigen. Ann. Phys. n. F. 59 (1896) 184-192; Nature 54 (1896) 377-378.
- Onnes, H. K.* Over de werking van het magnetisme op den aard der spectra. Zittingsversl. Akad. Amsterdam V (1896-1897) Januari.
- —. Un moyen d'éclairer les échelles pour la lecture des angles par la méthode du miroir. Arch. néerland. (2) 1 (1898) 405-410.
- Oppolzer, E. von.* Die Ursache der Sonnenflecken. Sitzb. Wiener Akad. 102 II (1893) 375-413, Beibl. (1894) 91.
- —. Beiträge zur Sonnenphysik. Astron. and Astrophys. 12 (1893) 736-743; Beibl. (1894) 563.
- —. Eine Bemerkung zur astronomischen Strahlenbrechung. Astron. Nachr. 135 (1894) 159-162; Beibl. (1894) 763.
- —. Brester's views as to the tranquillity of the Solar atmosphere. Astrophys. J. 1 (1895) 260-262.
- —. Die Strahlenbrechung auf der Sonne; Otto Knopf, Die Schmidt'sche Sonnentheorie. Vierteljahrsschr. d. astron. Ges. 30 (1895) 24-39.
- —. Die photographische Extinction. Sitzb. Wiener Akad. 107 II (1898) 1477-1493; Beibl. (1899) 421; Astrophys. J. 9 (1899) 317-331.
- Orbinsky, Artemie.* Neue Methode zur Bestimmung der Geschwindigkeiten der Sterne im Visionsradius. Astron. Nachr. 138 (1895) 9-12; Beibl. (1896) 202.
- Ostwald, W.* Chemische Fernwirkung. Ztsch. phys. Chem. 9 (1892) 540-553.
- —. Die Farbe der Ionen. Abhandl. d. Ges. Wiss. Leipzig 18 (1892) 281-307; Beibl. (1892) 534; Ztsch. phys. Chem. 9 (1892) 579-603.
- —. Ueber rotes und gelbes Quecksilberoxyd. Ztsch. phys. Chem. 18 (1895) 159-161.
- Otto, M.* Sur l'ozone et les phénomènes de phosphorescence. C.-R. 123 (1896) 1005-1007; Beibl. (1897) 131.
- Otto.* Recherches sur l'ozone. La Nature 26 (1898) 209-290; Beibl. (1898) 847.

*Oudemans, J. A. C.* Die Aenderung der Helligkeit der Fixsterne zufolge der eigenen Bewegung in der Richtung der Gesichtslinie. *Astron. Nachr.* 137 (1895) 169-171; *Versl. Akad. Amsterdam* 3 (1895) 122-125.

## P

*Pagliani, S.* Sull' potere induttore specifico dei corpi e sulle costanti della rifrazione della luce. *Gazz. chim. Ital.* (1893) 537-553.

— —. Sulle equazioni della rifrazione della luce. *Rend. Accad. Roma* (5) 2 (1893) 107-112; *Beibl.* (1894) 335.

*Paige, C.* Le sur l'action du Soleil sur les plaques photographiques. *Bull. Acad. Belg.* (3) 34 (1897) 429-437, 802-803.

*Palisa, J.* Die Bahnbestimmung der Parallaxe von Doppelsternen. *Astron. Nachr.* 123 (1889) 201-204; *Beibl.* (1890) 789.

*Palmer, Jr., A. De F.* The wave-length of the D<sub>3</sub> Helium Line. *Amer. J. Sci.* (3) 50 (1895) 357-359; *Beibl.* (1896) 197; *Phil. Mag.* (5) 39 (1895) 547-549.

*Palmer, H. K.* Distribution of stars in the cluster Messier 13, in Hercules. *Astrophys. J.* 10 (1899) 246-254.

*Palmieri, L.* Bemerkung gelegentlich der Heliumlinie die in den Spektren einer Sublimation am Vesuv auftrat und jetzt von Ramsay und Cleve wieder gesehen worden ist. *Napoli Rend.* (3) 3 (1895) 121-122; *Beibl.* (1896) 531.

*Parkhurst, H. M.* Notes on variable stars, No. 8. *Astron. J.* 15 (1895) 76-77, 105-106, 162-165; 16 (1896) 36-38, 93-95, 132-135, 209-210; 17 (1896) 5-6, 25-26, 65-67, 80, 87, 122-125, 147-149.

— — —. On the light curve of 103 T Andromedae. *Astron. J.* 15 (1895) 135-136.

*Parkhurst, J. A.* Maxima and minima of Long-Period Variables; *Astron. J.* 15 (1895) 99-100, 177-179; 16 (1896) 110, 184; 17 (1897) 102-103, 167-168, 182.

— — —. On the variation of the Holden-Espin red star. *Astron. J.* 16 (1896) 23.

— — —. Observations of suspected variables. *Astron. J.* 16 (1896) 183.

— — —. The missing star B. D. + 7° 5106. *Astron. Nachr.* 142 (1897) 353.

- Parry, J.* On the spectra of the gases and vapors evolved on heating iron and other metals. London; Pontypool, 1885, 54 pp., Beibl. (1890) 853.
- — —. The spectrum of iron and the Periodic Law. *Nature* 45 (1892) 253-255; Beibl. (1893) 748.
- — —. The spectrum of the Bessemer Flame and the hardening of steel. *Engineering* 60 (1895) 585.
- Paschen, F.* Bolometrische Untersuchungen im Gitterspectrum. *Ann. Phys. n. F.* 48 (1893) 272.
- — —. Gesamtmission glühenden Platins. *Ann. Phys. n. F.* 49 (1893) 50.
- — —. Die Emission erhitzter Gase. *Ann. Phys. n. F.* 50 (1893) 409.
- — —. Ueber die Emission der Gase. *Ann. Phys. n. F.* 51 (1894) 1; 52 (1894) 209.
- — —. Gültigkeit des Kirchhoff'schen Gesetzes von der Emission. *Ann. Phys. n. F.* 51 (1894) 40.
- — —. Bolometrische Arbeiten. *Ann. Phys. n. F.* 53 (1894) 287-300.
- — —. Dispersion des Fluorits im Ultraroth. *Ann. Phys. n. F.* 53 (1894) 301.
- — —. Die genauen Wellenlängen der Banden des ultrarothern Kohlensäure- und Wasserspectrums. *Ann. Phys. n. F.* 53 (1894) 334-336.
- — —. Ueber die Dispersion des Steinsalzes im Ultraroth. *Ann. Phys. n. F.* 53 (1894) 337-342.
- — —. Die Dispersion des Fluorits und die Ketteler'sche Theorie der Dispersion. *Ann. Phys. n. F.* 53 (1894) 812-822.
- — —. Dispersion und Dielectricitätsconstante. *Ann. Phys. n. F.* 54 (1895) 668-674.
- — —. Die Wellenlängenscala des ultrarothern Flusspathspectrums. *Ann. Phys. n. F.* 56 (1895) 762-767.
- — —. Ueber Gesetzmässigkeiten in den Spektren fester Körper, und eine neue Bestimmung der Sonnentemperatur. *Gött. Nachr.* (1895) 11 pp.; *Astrophys. J.* 2 (1895) 202-211.
- — —. Gesetzmässigkeiten in den Spektren fester Körper. *Ann. Phys. n. F.* 58 (1896) 455-492; 60 (1897) 662-723; *Astrophys. J.* 5 (1897) 60-63 Abs.
- — —. Die Verteilung der Energie im Spektrum des schwarzen Körpers bei niederen Temperaturen. *Sitzb. Berliner Akad.* (1898) 405-420.; *Astrophys. J.* 10 (1899) 40-57.

- Paschen, F. und H. Wanner.* Eine photometrische Methode zur Bestimmung der Exponentialkonstanten der Emissionsfunktion. Sitzb. preuss. Akad. 1899, 7 pp.; Astrophys. J. (1899) 300-307.
- Paterson, A. G.* Observations of Jupiter's red-spot. Jour. B. A. A. 5 (1895) 211-212.
- Paterson, D.* Efflorescence of double ferrous aluminum sulfate on bricks exposed to sulphur dioxid. J. Chem. Soc. 67 (1895) 66-68.
- Patterson, T. L.* Spectrum-Photometer, for the determination of the absorption spectra of dye-stuffs. J. Soc. Chem. Indust. Manchester, Eng. 9 (1890) 36; Beibl. (1892) 606.
- Pauer, J.* Die Absorptionsspectra einiger Verbindungen im dampfförmigen und flüssigen Zustand. Sitzb. Soc. Erlangen (1895) 7 pp.; Beibl. (1896) 696.
- . Absorption ultravioletter Strahlen durch Dämpfe und Flüssigkeiten. Ann. Phys. n. F. 61 (1897) 363-369.
- Paul, H. M.* Observations of X Hydrae. Amer. J. Sci. (4) 15 (1895) 103.
- . Confirmations of variability. Astron. J. 15 (1895) 132-133, 182-183.
- . Observations of two Southern variables. Astron. J. 15 (1895) 173; 16 (1896) 84.
- . Observations and elements of two variables. Astron. J. 16 (1896) 176-177.
- Paulsen, A.* Sur la nature et l'origine de l'aurore boréale. Overs. Danske Vid. Forh. (1894) 148-168; Beibl. (1895) 427.
- Pawlewski, Br.* Ueber fluorescirende Körper. Ber. chem. Ges. 31 (1898) 310.
- . Fluorescenz der Anthranilsäure. Ber. chem. Ges. 31 (1898) 1693.
- Peddie, W.* Proof that density of illumination does not affect absorption. Rept. Brit. Assoc. (1892) 661; Beibl. (1893) 1058.
- Pedler, A.* Effect of chlorine on water in light, and the effect of light on certain compounds of chlorine. J. Chem. Soc. 57 (1890) 613-625; Beibl. (1890) 1102.
- Peck, C. E.* Variable star observations, 1895. Eng. Mech. 62 (1895) 289, 377.
- Pellat.* Renversement des raies spectrales. Méthode pour déterminer la température du Soleil. Bull. Soc. philomath. Paris 11 (1886) 155-160; Beibl. (1887) 705.

- Pellat*. De la couleur verte du dernier rayon solaire. Bull. Soc. philom. Paris 12 (1887) 22-23; Beibl. (1888) 662.
- Pellin et Broca*. Spectroscope à déviation fixe. J. de phys. 8 (1899) 314-319.
- Perkin, W. H.* The refractive power of certain organic compounds at different temperatures. Chem. News 63 (1891) 18-21; J. Chem. Soc. (5) 61-62 (1892) 287-310, Beibl. (1893) 559.
- . Influence of temperature on the refractive power and on the refractive equivalents of Acetylacetone and of Ortho- and Paratoluidine. J. Chem. Soc. 67-68 (1895) 1-7; Chem. News 72 (1895) 288.
- Perner, J. M.* Scintillometerbeobachtungen auf dem hohen Sonnenblick (3095 m.) im Jahre 1888 (18. Oct. 1888). Sitzb. Wiener Akad. 96 II (1888) 1299-1306; 97 II (1889) 1562-1586; Beibl. (1889) 686.
- . Die Theorie des ersten Purpurlichtes. Meteorol. Ztsch. 7 (1890) 41-50.
- . Die blaue Farbe des Himmels. Beibl. (1890) 806.
- . Luminous phenomena observed on mountains. Nature 56 (1897) 80.
- . Die Farben des Regenbogens und der weisse Regenbogen Wiener Anzeiger (1897) 6; Sitzb. Wiener Akad. 106 II (1897) 135-235.
- . Neues über Regenbogen. Beibl. (1899) 640.
- Perot, A., et C. Fabry*. Construction des lames étalons pour la mesure optique de petites épaisseurs d'air. C.-R. 123 (1896) 990-993.
- . Nouvelle méthode de spectroscopie interférentielle. C.-R. 126 (1898) 34-36.
- . Étude de quelques radiations par la spectroscopie interférentielle. C.-R. 126 (1898) 407-410.
- . Méthode pour la mesure optique de longueurs d'onde pouvant atteindre plusieurs décimètres. C.-R. 126 (1898) 1779-1782.
- . Méthodes interférentielles pour la mesure des grandes épaisseurs et la comparaison des longueurs d'onde. Ann. chim. phys. 16 (1899) 289-338; Astrophys. J. 9 (1899) 87-115.
- Perrean, F.* Étude expérimentale de la dispersion et de la réfraction des gaz. J. de phys. (3) 4 (1895) 411-416; Thèses, Paris 1895, 60 pp.; Beibl. (1896) 192.
- Perrigot* Sur la lumière noire. C.-R. 124 (1897) 857-859.—See H. Becquerel, *ibid.* 984-988.

- Perrot, F. L.* Brechung und Dispersion zweiaxiger Krystalle. C.-R. 111 (1890) 967; Jahresb. (1890) 392.
- . Réfraction et dispersion dans une série isomorphe de cristaux à deux axes (sulfates doubles à 6 H<sub>2</sub>O). Arch. de Genève 25 (1891) 26-70; Beibl. (1891) 357.
- Perrotin, J.* Le phénomènes crépusculaires et la lumière cendrée de Vénus. C.-R. 122 (1896) 1038-1042.
- . La comète périodique Giacobini. C.-R. 123 (1896) 925-928.
- . La planète Mars. C.-R. 124 (1897) 340-346.
- . Probable new variable in Puppis. (S. Dm.-20° 2007). Astron. J. 17 (1897) 110.
- Petersson, O.* Chemistry of the elements of the rare earths. Bih. Svensk. Akad. Handl. 21 (1895) 16 pp., sep.
- Pettinelli, P.* Sulla temperatura minima di luminosità. Nuov. Cim. (4) 1 (1895) 183-186; Beibl. (1895) 633.
- . Die Aenderung der Warmedurchlässigkeit des Glases und des Glimmers mit der Temperatur. Nuov. Cim. (4) 2 (1895) 156-159; Beibl. (1896) 369.
- . Sulla permeabilità per i raggi oscuri delle lamine sottili di varie sostanze diafane. Nuov. Cim. (4) 2 (1895) 356-359; Beibl. (1895) 784; (1896) 534.
- . Sulla dipendenza della conductibilità elettrica delle fiamme dalla natura degli elettrodi. Atti Accad. Lincei 5 (1896) 118-120.
- Peyra, D.* Osservazioni di Venere nel 1895. Mem. Spettr. Ital. 25 (1896) 103-104.
- . Sopra Marte opposizione, 1896-1897. Mem. Spettr. Ital. 26 (1897) 61-64.
- Pfaundler, L.* Ein Wellenapparat zur Demonstration der Zusammensetzung der Transversalwellen. Ztsch. Phys. u. chem. Unterr. 1 (1887) 98-102.
- Pflugger, A.* Anomale Dispersionskurven einiger fester Farbstoffe. Ann. Phys. n. F. 56 (1895) 412-432; Astrophys. J. 5 (1897) 67 Abs.
- . Die Brechungsindices der Metalle bei verschiedenen Temperaturen. Ann. Phys. n. F. 58 (1896) 493-499; Astrophys. J. 5 (1897) 68 Abs.
- . Zur anomalen Dispersion absorbirender Substanzen. Ann. Phys. n. F. 58 (1896) 670-673.
- . Prüfung der Ketteler's Helmholtz'schen Dispersionstformeln an den optischen Konstanten anomal dispergirender, fester Farbstoffe. Ann. Phys. n. F. 65 (1898) 173-213, 225-228; Astrophys. J. 9 (1899) 187.



- Hüger, A.* Prüfung der Cauchy'schen Formeln der Metallreflexion an den optischen Konstanten des festen Cyanins. *Ann. Phys. n. F.* 65 (1898) 214-224.
- Iccini, A.* Il sistema periodico di Mendelejeff e i nuovi componenti dell'aria. *Gazz. chim. Ital.* 28 II (1898) 169-181.
- ickering, E. C.* The Henry Draper Memorial. First Annual Report of the Photographic Study of Stellar Spectra conducted at Harvard College Observatory, Cambridge. J. Wilson & Son, 1887, 10 pp. (Reports every year since then.) *Beibl.* (1887) 637; *Rept. Brit. Assoc.* (1887) 622.
- . *Sterne mit besonderen Spectren.* *Astron. Nachr.* 122 (1889) 159-160; *Beibl.* (1890) 1100.
- . *Spectrum von Plejone.* *Astron. Nachr.* 123 (1889) 95-96.
- and *O. C. Wendell.* Discussion of observations made with the Meridian-Photometer during the years 1882-1888. *Annals of Harv. Observ.* 23 (1890) 136 pp., 4to, Cambridge, U. S. A., 1890.
- . *Results of observations with the Meridian-Photometer.* *Ann. Harvard Coll. Observ.* 24 (1890) 268 pp., 4to; *Beibl.* (1891) 354.
- . *Spectrum of  $\zeta$  Ursae Majoris.* *Amer. J. Sci.* (3) 39 (1890) 40-47; *Beibl.* (1890) 515.
- . *The Draper Catalogue of Stellar Spectra.* *Ann. Harvard Observ.* 27 (1890) 388 pp.; *Beibl.* (1891) 646.
- . *Vertheilung der Energie in Sternspectren.* *Astron. Nachr.* 128 (1891) 377-380; *Beibl.* (1894) 97.
- . *The constitution of stars.* *Astron. and Astrophys.* 12 (1893) 718-722; *Beibl.* (1894) 673.
- . *Researches on the Zodiacal Light and on a photographic determination of the atmospheric absorption.* *Harv. Coll. Observ. Annals* 19 II (1893) 165-331.
- . *The new star in Norma.* *Astron. and Astrophys.* 13 (1894) 40-41, 398; *Beibl.* (1894) 768.
- . *Photographic determination of stellar motions.* *Astron. and Astrophys.* 13 (1894) 521-524.
- . *Discovery of variable stars from their photographic spectra.* *Astrophys. J.* 1 (1895) 27-28, plate.
- . *Comparison of the photometric magnitudes of the stars.* *Astrophys. J.* (1895) 154-159.
- . *T. Andromedae.* *Astrophys. J.* (1895) 305-308.

- Pickering, E. C. (Cont'd).* A new form of stellar photometer. *Astrophys. J.* 2 (1895) 89-96; *Beibl.* (1896) 197.
- . The new star in Carina. *Observ.* 18 (1895) 436, 443; *Beibl.* (1897) 345.
- . Variable star clusters. *Astron. Nachr.* 139 (1896) 137-140; *Beibl.* (1897) 345.
- . New variable star in Delphinus of Algol type. *Astron. Nachr.* 139 (1896) 224.
- . Wells's Algol Variable in Delphinus. *Astron. Nachr.* 140 (1896) 23.
- . The new star in Centaurus. *Astron. Nachr.* 140 (1896) 24-25; *Astrophys. J.* 3 (1895) 162-163.
- . New variable stars. *Astron. Nachr.* 140 (1896) 173-175.
- . The Cluster Messier 5 Serpentis N. G. C. 5904. *Astron. Nachr.* 140 (1896) 285-287.
- . Ten new variable stars. *Astron. Nachr.* 141 (1896) 34-37.
- . Stars having peculiar spectra. *Harvard Observ. Cir.* No. 9 (1896); *Astron. Nachr.* 141 (1896) 169; *Astrophys. J.* 4 (1896) 142-143.
- . Six new variable stars. *Astron. Nachr.* 141 (1896) 311; *Astrophys. J.* 4 (1896) 234.
- . Photometric light-curves of U Cephei and S Antliae. *Astron. Nachr.* 142 (1896) 9-12; *Astrophys. J.* 3 (1896) 281-285.
- . Stars having peculiar spectra. New variable stars in Crux and Cygnus. *Astron. Nachr.* 142 (1896) 87-89.
- . New variable star of the Algol type. *Harvard Observ. Cir.* 7 (1896); *Astrophys. J.* 3 (1896) 77, note.
- . A new spectroscopic binary in Scorpii. *Harv. Observ. Cir. No.* 11 (1896); *Astrophys. J.* 4 (1896) 235; *Astron. Nachr.* 142 (1896) 11-13.
- . Relative motion of stars in the line of sight. *Astrophys. J.* 4 (1896) 370-373; *Astron. Nachr.* 142 (1896) 105-107.
- . The Bruce Photographic Telescope. *Astron. Nachr.* 142 (1897) 367-369.
- . The spectrum of Z Puppis. *Astron. Nachr.* 142 (1897) 399-401; *Astrophys. J.* 5 (1897) 92-94.
- . Stars having peculiar spectra, and distribution of stars in a cluster. *Astrophys. J.* 5 (1897) 350-353.
- . Variable star clusters. *Astrophys. J.* 6 (1897) 258-259.



- Pickering, E. C.* Spectra of bright Southern stars. *Astrophys. J.* 6 (1897) 349-352.
- . Large Magellanic Cloud. *Harv. Coll. Observ. Cir.* 19 (1897); *Astrophys. J.* 6 (1897) 459-461.
- . Spectrum of a meteor. *Harv. Coll. Observ. Cir.* 19 (1897); *Astrophys. J.* 6 (1897) 461; *Nature* 57 (1897) 101.
- . The Algol variable + 17° 4367 W Delphini. *Astrophys. J.* 7 (1898) 23-24.
- . A variable bright Hydrogen line. *Harv. Cir.* 21 (1897); *Astrophys. J.* 7 (1898) 139.
- . Photographic spectrum of the Aurora. *Astrophys. J.* 7 (1898) 392; *Harvard Observ. Cir.* 28 (1898).
- . Stars having peculiar spectra. (With one exception they were discovered by Mrs. Fleming on the Draper Memorial Photographs. Note.) *Harv. Observ. Cir.* 32 (1898); *Astrophys. J.* 8 (1898) 116-118.
- . Stars resembling  $\epsilon$  Puppis. *Astrophys. J.* 8 (1898) 119.
- . A new form of photographic telescope. *Harv. Observ. Cir.* 39 (1899); *Astrophys. J.* 9 (1899) 175-178.
- . Photographing meteors. *Harv. Observ. Cir.* 40 (1899); *Astrophys. J.* 9 (1899) 178-179.
- . The variable stars U Vulpeculae and S T Cygni. *Harv. Observ. Cir.* 41 (1899); *Astrophys. J.* 9 (1899) 179-182.
- . A new star in Sagittarius. *Harv. Observ. Cir.* 42 (1899); *Astrophys. J.* 9 (1899) 182-184.
- Pickering, S. U.* Chemical action at a distance. *Phil. Mag.* (5) 32 (1891) 478-480.
- . Chemical action and the conservation of energy. *Nature* 43 (1891) 165-167.
- . Das kryoscopische Verhalten schwacher Lösungen. *Ber. chem. Ges.* 25 (1892) 1099-1108, 1314-1324, 1854-1866, 2012-2017, 2518-2524.
- Pickering, W. H.* A study of Nova Aurigae and Nova Normae. *Astron. and Astrophys.* 13 (1894) 201-204; *Beibl.* (1895) 175.
- . Investigations in Astronomical Photography. *Annals Harvard Observ.* 31 I (1895) 114 pp.; *Beibl.* (1896) 39.
- . Atmosphere et rivières lunaires. *Bull. Soc. astron. France* 1 (1895) 306-316.
- . La météorologie de Mars. *Bull. Soc. Belg. d'Astron.* 2 (1897) 221-224.

- Pictet, R.* Étude des phénomènes physiques et chimiques sous l'influence de très basses températures. C.-R. 114 (1892) 1245-1248.
- . Influence des basses températures sur les phénomènes de phosphorescence. C.-R. 119 (1894) 527-529; Beibl. (1895) 224.
- . Étude sur le rayonnement aux basses températures; application à la thérapeutique. Arch. de Genève (3) 32 (1894) 233-254, 465-480, 561-573.
- Piltchikoff, N.* La polarization spectrale du ciel. C.-R. 115 (1892) 555-558; Beibl. (1893) 337.
- . L'émission des rayons de Röntgen par un tube contenant une matière fluorescente. C.-R. 122 (1896) 461-462.
- Pitcher, F. B.* Absorption spectra of certain blue solutions. Amer. J. Sci. (3) 36 (1888) 332-336; Beibl. (1889) 218.
- Pizzetti, P.* La rifrazione astronomica calcolata in base alla ipotesi di Mendeleef sulla distribuzione verticale della temperatura nell'aria. Atti Accad. Torino 33 (1898) 213-226.
- Planck, M.* Absorption und Emission elektrischer Wellen durch Resonanz. Ann. Phys. n. F. 57 (1896) 1.
- . Ueber irreversible Strahlungsvorgänge. Sitzb. Berliner Akad. (1897) 57-68, 715-717, 1122-1145; (1899) 440-480.
- Plassmann, J.* Rauchkeilbeobachtungen von  $\eta$  Aquilae. Astron. Nachr. 139 (1895) 171-174.
- Plummer, W. E.* The atmospheric absorption of light. Nature 55 (1896) 235-236.
- . A photometric catalogue of Southern Stars (Harvard). Mon. Not. (1897) 294-296.
- Pockels, Fr.* Die Interferenzerscheinungen, welche Zwillingsplatten optisch einaxiger Krystalle im convergenten homogenen polarisirten Lichte zeigen. Göttinger Nachr. (1890) 259-278.
- Poincaré, H.* Théorie mathématique de la lumière. Paris: G. Carré, 1889, 418 pp.; Beibl. (1890) 84; Berlin: J. Springer 1894, 295 pp., Fig.
- . Mode anormale de propagation des ondes. C.-R. 113 (1891) 16-18; Beibl. (1892) 603.
- . Sur le spectre cannelé. C.-R. 120 (1895) 757-762; Beibl. (1895) 788.
- . Remarque sur un mémoire de M. Jaumann intitulé: "Longitudinales Licht." C.-R. 121 (1895) 792-794.
- . Les rayons cathodiques et la théorie de Jaumann. Eclairage électrique 9 (1896) 241-251.

- Poincaré, H.* La théorie de Lorentz et les expériences de Zeemann. Éclairage électr. 11 (1897) 481-489; 1188) 99) 5-15.
- . Ueber die Stabilität des Sonnenspectrums. Naturwiss. Rundsch. 13 (1898) 413-417.
- . Le phénomène de Hall et la théorie de Lorentz. C.-R. 128 (1899) 339-341.
- Politzinc, A.* Sur les hydrates du chlorure de cobalt et sur les changements de couleur de ce composé. Bull. Soc. chim. (1891) 264-266.
- Poor, Ch. L., and S. A. Mitchell.* The concave grating for stellar photography. Astrophys. J. 7 (1898) 157-163; Johns Hopkins Cir. 17 (1898) 61-62.
- . The direct grating spectroscop. Astrophys. J. 8 (1898) 235-236.
- Pope, W. F.* Ein bemerkenswerter Fall von Phosphorescenz. Ztsch. f. Kryst. u. Min. 25 (1896) 567-571; Beibl. (1896) 373.
- . The refraction-constants of crystalline salts. J. Chem. Soc. 69 (1896) 1530-1536; Ztsch. f. Kryst. u. Min. 28 (1897) 113-128.
- . Angular measurement of optic axial emergences. Proc. Roy. Soc. 60 (1896) 7-10.
- Porter, T. C.* Solution of alum. Nature 45 (1891) 29; Beibl. (1892) 279.
- . The first visible colour of glowing iron. Nature 45 (1892) 558-559.
- . Contributions to the study of "Flicker." Proc. Roy. Soc. 63 (1898) 347-356.
- Potier, A.* Le principe du retour des rayons et la réflexion cristalline. J. de phys. (2) 10 (1891) 349-357.
- Poynting, J. H.* A graphic method for the explanation of the refraction fringes on the border of a shadow. Proc. Birmingham Phil. Soc. 7 (1890) 210-219; Beibl. (1891) 562.
- Precht, J.* Das Phosphoresciren der Gelatineplatten und die Luminescenz der Pyrogallensäure. Photogr. Rundsch. 9 (1895) 320-324; Beibl. (1896) 203.
- . Neuere Untersuchungen über die Gültigkeit des Bunsen Roscoe'schen Gesetzes. Astrophotometrische Untersuchungen. Archiv. f. wissensch. Photogr. 1 (1899) 149-151.
- Preston, Th.* The Theory of Light. London; Macmillan 1890, 465 pp.
- . Photography of the Zeeman Effect. Nature 57 (1897) 173; Beibl. (1898) 355.

- Preston, Th. (Cont'd).* On the universal application of Fourier's theorem. *Phil. Mag.* (5) 43 (1897) 281-285; *Beibl.* (1897) 628.
- . On a supposed proof of a theorem in a wave-motion. *Phil. Mag.* (5) 43 (1897) 458-460.
- . General Law of the Phenomena of Magnetic Perturbations of Spectral Lines. *Nature* 59 (1898) 248, 367-368.
- . The Interferometer. *Nature* 59 (1898) 605.
- . Radiation phenomena in the magnetic field. Magnetic perturbations of the spectral lines. *Phil. Mag.* (5) 47 (1899) 165-179; *Beibl.* (1899) 508.
- . Modifications of the spectra of iron and other substances radiating in a strong magnetic field. *Proc. Roy. Soc.* 63 (1898) 26-31.
- . The magnetic perturbations of the spectral lines. *Nature* 60 (1899) 175-180.
- Preyer, W.* Ueber das genetische System der chemischen Elemente. *Verh. d. phys. Ges. Berlin* 10 (1891) 85-88.
- . Zur Geschichte der Dreifarbenlehre. *Ztsch. f. Psychol. u. Physiol. d. Sinnesorgane* 11 (1896) 405-408.
- Pringsheim, E.* Argandlampe für Spectralbeobachtungen. *Ann. Phys. n. F.* 45 (1892) 426.
- . Das Kirchhoff'sche Gesetz und die Strahlung der Gase. *Ann. Phys. n. F.* 45 (1892) 428; 49 (1893) 347.
- . Bemerkungen zu Hern. Paschen's Abhandlung "Ueber die Emission erhitzter Gase." *Ann. Phys. n. F.* 51 (1894) 441.
- . Ueber ein Interferenzmikroskop. *Verh. d. phys. Ges. Berlin* 17 (1898) 152-156.
- Pringsheim, N.* Zur Beurtheilung der Engelmann'schen Bakterienmethode in ihrer Brauchbarkeit zur quantitativen Bestimmung der Sauerstoffabgabe im Spektrum. *Ber. deutsch. botan. Ges.* 4 (1886) Hft. 11.
- Provenzali, P. F. S.* Ueber die Unfähigkeit der Metalle die physikalische Phosphoreszenz anzunehmen. *Beibl.* (1891) 281; *Atti Accad. Lincei* 43 (1890) 131-138.
- ——. Sulla intensità della luce diffusa. *Atti Accad. Lincei* 45 (1892) 29-35.
- Prunhes, B.* Reflexion interne dans les cristaux doués du pouvoir rotatoire. *Séance Soc. fr. de Phys.* 3 (1895) 162-165.
- Prytz, K., und H. Holst.* Absorptioncoefficienten for Kulsyre og Svoolbrinte i Vand ved dettes Freysepunkt. *Oefvers. K. Danske Forh.* (1894) 12 pp.

- Pulfrich, C.* Das Totalreflectometer. Ann. Phys. n. F. 31 (1887) 724-734.
- —. Zur Theorie des Regenbogens und der überzahligen Bogen. Ann. Phys. n. F. 33 (1888) 194-209, 209-212.
- —. Lichtbrechungsverhältnisse des Eises und des unterkühlten Wassers. Ann. Phys. n. F. 34 (1888) 326.
- —. Brechungsvermögen von Mischungen zweier Flüssigkeiten. Ztsch. phys. Chem. 4 (1889) 312, 561.
- —. Dispersionsbestimmung nach der Totalreflexionsmethode mittels mikrometrischer Messung. Ztsch. f. Instrum. 13 (1893) 267-273.
- —. Eine neue Spektroskop-Konstruktion. Ztsch. f. Instrum. 14 (1894) 354-364. Astrophys. J. 1 (1895) 335-349.
- —. Ein neues Refractometer. Beibl. (1895) 191; Ztsch. f. Instrum. 15 (1895) 389-394. J. de phys. (3) 5 (1896) 73-79.
- —. Einfluss der Temperatur auf die Lichtbrechung der Metalle. Ann. Phys. n. F. 59 (1896) 671.
- —. Apparat zur Demonstration des Fizeau'schen Phanomens. Ztsch. f. Instrum. 17 (1897) 239-241; Beibl. (1898) 34.
- —. Ein Natriumbrenner für Laboratoriumszwecke. Ztsch. f. Instrum. 18 (1898) 52.
- —. Einige Neueinrichtungen an dem Doppelprisma des Albeschen Refraktometers. Beibl. (1898) 661.
- —. Ein Interferenzapparat. Ztsch. f. Instrum. (1898) 261-267.
- —. Ein Vergleichsspektroskop für Laboratoriumszwecke. Ztsch. f. Instrum. 18 (1898) 381-383; Beibl. (1899) 249, 774.
- —. Ueber die Anwendbarkeit der Methode der Totalreflexion auf kleine und mangelhafte Krystallflächen. Ztsch. f. Kryst. 30 (1898) 568-586; Beibl. (1899) 354.

## Q

- Quesneville, G.* De la double réfraction elliptique et de la tetrafrinence du quartz dans le voisinage de l'axe. C.-R. 121 (1895) 522-525; Beibl. (1896) 204.
- —. De la mesure des différences de marche dans la réfraction elliptique du quartz. C.-R. 121 (1895) 1136-1139.
- Quesnisset, F.* Observations de Mars. Bull. Soc. astron. France (1897) 227-239.
- —. Observations de Jupiter. Bull. Soc. astron. France (1897) 318-323.

*Quinan, W. R.* Some physical aspects of the new gas, Argon. The ideal thermometrical substance for high temperatures. *J. Amer. Chem. Soc.* 17 (1895) 477-483.

## R

*Radau.* Sur la théorie des réfractions astronomiques. *Bull. astron.* 1 (1884.) 1.

*Raddi, A.* Der Intensivbrenner Auer, über seinen Nutzen und Vergleiche mit dem electrischen Licht. *Beibl.* (1894) 997.

*Radiguet.* Fluorescence des matières vitrifiées, sous l'action des rayons Röntgen. *C.-R.* 124 (1897) 179-180.

*Raid, H. F.* Theory of the Bolometer. *Amer. J. Sci.* (3) 35 (1888) 160-166; *Beibl.* (1888) 337.

*Rambaut, A. A.* On the inequality in the apparent diurnal movement of stars due to refraction, and a method of allowing for it in astronomical photography. *Mon. Not.* 57 (1896) 50-62.

*Ramsay, W.* Ueber die Absorption des Lichtes im Epidot vom Sulzbachthal. *Ztsch. f. Kryst. u. Min.* 13 (1887) 97-134; *Beibl.* (1888) 53.—See Becquerel, *C.-R.* 108 (1889) 282-284.

———. A gas showing the spectrum of Helium, the reputed cause of  $D_3$ , one of the lines in the coronal spectrum. *Proc. Roy. Soc.* 57 (1895) 65-67.

———. A gaseous constituent of certain minerals. *Proc. Roy. Soc.* 57 (1895) 81-89; *Chem. News* 71 (1895) 151; *Beibl.* (1895) 634.

———. A possible compound of Argon. *Chem. News* 72 (1895) 41-43, 51, 53-54, 72.

——— and *J. N. Collie.* Helium and Argon. *Chem. News* 73 (1895) 259-260.

———. Terrestrial Helium (?). *Nature* 51 (1895) 512; *Astrophys. J.* 1 (1895) 439, abs.

——— vs. *J. N. Lockyer.* Terrestrial Helium (?). *Nature* 52 (1895) 7-8.

——— and *J. N. Lockyer.* Terrestrial Helium. *Nature* 52 (1895) 55-57.

———. Argon and Helium in meteoric iron. *Nature* 52 (1895) 224-225; *C.-R.* 120 (1895) 1049-1050.

———, *J. N. Collie*, and *M. W. Travers.* Helium, a constituent of certain minerals. *Nature* 52 (1895) 306-308, 331-334.

———. Attempt to liquefy Helium. *Nature* 52 (1895) 544.



- Ramsay, W.* The gases of the atmosphere, the history of their discovery. London, Macmillan, 1896, 240 pp., with portraits.
- . Helium, a gaseous constituent of certain minerals. *Proc. Roy. Soc.* 59 (1896) 325-330.
- and *J. N. Collie*. Helium and Argon. Experiments which show the inactivity of these elements. *Proc. Roy. Soc.* 60 (1896) 53-56.
- . Homogeneity of Argon and of Helium. *Nature* 54 (1896) 406-407; *C.-R.* 123 (1896) 214-216; *Proc. Roy. Soc.* 60 (1896) 206-216.
- and *M. W. Travers*. The gaseous constituents of certain mineral substances and natural waters. *Proc. Roy. Soc.* 60 (1897) 442-448.
- . The refractivity of certain mixtures of gases. *Rept. Brit. Assoc.* (1897) 587-588.
- . On the refractivities of Air, Oxygen, Nitrogen, Argon, Hydrogen, and Helium. *Proc. Roy. Soc.* 62 (1898) 225-232; *Beibl.* (1898) 217.
- . The homogeneity of Helium. *Proc. Roy. Soc.* 62 (1898) 316-324; *Beibl.* (1898) 267.
- . Fergusonite, an endothermic mineral. *Proc. Roy. Soc.* 62 (1898) 325-329; *Beibl.* (1898) 266.
- . A new constituent of atmospheric air. *Proc. Roy. Soc.* 63 (1898) 405-408, *C.-R.* 126 (1898) 1610-1613, 1762-1763; *Beibl.* (1898) 513, *Nuov. Cim.* 7 (1898) 390-393. (Metargon and Krypton.)
- . The extraction of the companions of Argon and of Neon. *Chem. News* 78 (1898) 154-155.
- . Note on new gases in the Earth's atmosphere; Krypton, Neon, Metargon. *Proc. Roy. Soc.* June 3, 1898; *Astrophys. J.* 8 (1898) 120-122.
- and *E. C. Baily*. The Spectrum of Metargon. *Nature* 58 (1898) 245-246; *Beibl.* (1898) 772.
- . On the companions of Argon. *Proc. Roy. Soc.* 63 (1898) 437-440; *Naturw. Rundsch.* 13 (1898) 349-350, *Beibl.* (1898) 513.
- . The preparation and some of the properties of pure Argon. *Chem. News* 79 (1899) 49-50.
- . Note on the densities of Atmospheric Nitrogen, Pure Nitrogen, and Argon. *Proc. Roy. Soc.* 64 (1899) 181-183.
- Rancken, E.* Untersuchung über das Linienspektrum des Schwefels. *Diss. Helsingfors* 1897, 52 pp., *Beibl.* (1899) 97.

- Ransohoff, M.* Die Verteilung des Absorptionsvermögens einiger einfacherer Kohlenstoffverbindungen im ultraroten Gebiete des Spectrums. Diss. Berlin 1896, 32 pp.; Beibl. (1897) 737.
- Rathenau, W.* Die Absorption des Lichtes in Metallen. Diss. Berlin 1889; Beibl. (1894) 189.
- Raveau, C.* Sur la théorie de la lumière. C.-R. 112 (1891) 853-855.
- —. Les rayons X et les rayons ultra-violets. J. de phys. (3) 5 (1896) 113-114.
- Rajet, G.* Une photographie de la nébuleuse annulaire de la Lyre, obtenue à l'observatoire de Bordeaux, le 20 juin 1890. C.-R. 111 (1890) 31-32.
- —. Les changements survenus dans la grande nébuleuse de la ceinture d'Andromède. C.-R. 127 (1898) 441-442.
- Rayleigh, Lord.* Colours of thin plates. Edinburgh Trans. 33 (1885-1886) 157-170; Beibl. (1888) 198-200.
- —. Achromatic interference bands. Phil. Mag. (5) 27 (1889) 189-206, 484-486; 28 (1889) 77-91, 189-206; Beibl. (1889) 697; (1890) 42.
- —. The History of Radiant Energy. Phil. Mag. (5) 27 (1889) 265-270; Beibl. (1889) 495.
- —. The limit to interference when light is radiated from moving molecules. Phil. Mag. (5) 27 (1889) 298-304; Beibl. (1889) 695.
- —. The character of the complete radiation at a given temperature. Phil. Mag. (5) 27 (1889) 460-469; Beibl. (1889) 1007.
- —. Iridescent Crystals. Proc. Roy. Instit. March 12, 1889, 3 pp.
- —. The composition of water. Proc. Roy. Soc. 45 (1889) 425-430.
- —. On Foam. Roy. Instit. Gt. Brit. March 28, 1890; Chem. News 62 (1890) 1-4, 17-19.
- —. On the vibration of an atmosphere. Phil. Mag. (5) 29 (1890) 173-180.
- —. The Bourdon Gauge. Nature 41 (1890) 197.
- —. Defective Colour-Vision. Rept. Brit. Assoc. (1890) 728-729.
- —. Report of the Committee on Colour-Vision. Proc. Roy. Soc. 51 (1891) 281-396.
- —. Photography with a small hole. Phil. Mag. (5) 31 (1891) 87-99; Beibl. (1891) 562.
- —. Dynamical problems in illustration of the theory of gases. Phil. Mag. (5) 32 (1891) 424-445.



- Rayleigh, Lord.* Some applications of photography. Roy. Inst. Gt. Brit. Feb. 6, 1891; Beibl. (1892) 667.
- —. Intensity of light reflected from water and mercury at nearly perpendicular incidence. Phil. Mag. (5) 34 (1892) 309-320; Beibl. (1893) 833.
- —. The interference bands of approximately homogeneous light; in a letter to Prof. A. Michelson. Phil. Mag. (5) 34 (1892) 407-410; Beibl. (1893) 835.
- —. Aberration. Nature. 45 (1892) 499-502; Beibl. (1892) 604.
- —. Density of Nitrogen. Nature 46 (1892) 512-513.
- —. Interference bands and their applications. Roy. Instit. Gt. Brit. March 24, 1893; Nature 48 (1893) 212-214.
- —. Theory of Stellar Scintillation. Phil. Mag. (5) 36 (1893) 129-142; Beibl. (1894) 564.
- —. The reflection of sound or light from a corrugated surface. Rept. Brit. Assoc. (1893) 690-691.
- —. A simple interference arrangement. Rept. Brit. Assoc. (1893) 703-704.
- —. An anomaly encountered in the determination of the density of nitrogen gas. Proc. Roy. Soc. 54 (1894) 340-344; Nature 50 (1894) 157-159.
- — and *W. Ramsay.* A new gaseous constituent of air. Proc. Roy. Soc. 57 (1895) 265-287; Rept. Brit. Assoc. (1894) 614; Z. phys. Chem. 15 (1894) 344-369; Smithsonian Contributions (1896) 43 pp.
- —. Argon. Nature 52 (1895) 52-57.
- —. Argon, a new constituent of the atmosphere. Chem. News 71 (1895) 51-58.
- —. The refraction and viscosity of Argon and Helium. Chem. News 72 (1895) 152; Beibl. (1896) 192; Rept. Brit. Assoc. (1895) 609.
- —. Argon, a lecture before the Roy. Inst. Gt. Britain, April 5, 1895. Science n. s. 1 (1895) 701-711.
- —. Some physical properties of Argon and Helium. Proc. Roy. Soc. 59 (1896) 198-208.
- —. The amount of Argon and Helium contained in the gas from the Bath Springs. Proc. Roy. Soc. 60 (1896) 56-57.
- —. More about Argon. Roy. Instit. Gt. Brit. Jan. 17, 1896.
- —. The reproduction of diffraction gratings. Nature 54 (1896) 332-333.

- Rayleigh, Lord (Cont'd).* On the passage of waves through apertures in plane screens, and allied problems. *Phil. Mag.* (5) 43 (1897) 259-272.
- . The propagation of waves along connected systems of similar bodies. *Phil. Mag.* (5) 44 (1897) 356-362.—See Wadsworth, *Astrophys. J.* 7 (1898) 77-85.
- . Note on the pressure of radiation, showing an apparent failure of the usual electromagnetic equations. *Phil. Mag.* (5) 45 (1898) 522-525.
- . The Interferometer. *Nature* 59 (1898) 533.
- . The transmission of light through an atmosphere containing small particles in suspension, and the origin of the Blue of the Sky. *Phil. Mag.* (5) 47 (1899) 375-385; *Beibl.* (1899) 424.
- . The Theory of Anomalous Dispersion. *Phil. Mag.* (5) 48 (1899) 151-152.
- Rebenstorff, H.* Ueber Farbenthermskope. *Ann. Phys. n. F.* 59 (1896) 227-232.
- Recoura, A.* Sur les états isomériques de l'acétate chromique, acétate anormal violet biacide, acétate anormal vert monacide. *C.-R.* 129 (1899) 288-291.
- Reese, H. and H.* Notes on the Zeeman Effect. *Johns Hopkins Univ. Cir.* 18 (1899) 59; *Phil. Mag.* (5) 48 (1899) 317-319.
- Reid, H. F.* Preliminary note of the radiation of incandescent Platinum. *Astrophys. J.* 2 (1895) 160-161; *Beibl.* (1896) 27.
- Reiff, R.* Die Fortpflanzung des Lichtes in bewegten Medien nach der electrischen Lichttheorie. *Ann. Phys. n. F.* 50 (1893) 361.
- . Zur Dispersionstheorie. *Ann. Phys. n. F.* 55 (1895) 82-94.
- Reinke, J.* Methode des Spectrophors. *Ann. Phys. n. F.* 27 (1886) 440.
- . Photometrische Untersuchungen über die Absorption des Lichts in den Assimilationsorganen. *Botan. Ztng.* (1886) Nos. 9-14; *Beibl.* (1887) 709.
- . Entgegnung bezüglich der subjectiven Absorptionsbänder. *Botan. Ztng.* (1887) No. 17; *Beibl.* (1887) 709.
- Remsen, Ira.* Argon. *Science n. s.* 1 (1895) 309-311.
- Renz, F.* Die Aufmessung und Berechnung einiger photographischer Sternaufnahmen. *Bull. Akad. St. Petersburg.* 5 II (1895) 293-331.
- Report of the Committee on the Ultra-Violet Spark Spectra emitted by Metallic Elements; drawn up by Prof. W. M. Hartley (Secretary).* *Rept. Brit. Assoc.* (1885) 276-284.

- Report of the Committee* for preparing a new series of Wave-Length Tables of the Spectra of the Elements; drawn up by Dr. W. Marshall Watts. Rept. Brit. Assoc. (1887) 624. (Continued every year since then.)
- Report of the Committee* on the Absorption Spectra of Pure Compounds. Rept. Brit. Assoc. (1889) 227; (1890) 339. (1891) 275.
- Report of the Committee* on the Ultra-Violet Rays of the Solar Spectrum; drawn up by Dr. C. Piazzi Smyth. Rept. Brit. Assoc. (1891) 147-148; (1892) 74-76.
- Rheden, J. Mars Beobachtungen, 1896; Sirius 26 (1897) 58-61.
- Riccó, A. Ueber die mittleren heliographischen Breiten und die Häufigkeit der Sonnenprotuberanzen auf den beiden Sonnenhemisphären in der Zeit von 1880-1888. Astron. Nachr. 122 (1889) 259-262; 124 (1890) 255-256.
- , Sopra un modo facile di studiare la rifrazione atmosferica. Rend. Accad. Roma 6 (1890) 13-17.
- , Sulla percezione più rapida delle stelle più luminose. Mem. Spettr. Ital. 22 (1893) 3 pp.; Beibl. (1894) 917.
- , Sulla relazione fra le perturbazioni magnetiche e la macchie solari. Mem. Spettr. Ital. 24 (1894) 3 pp.
- , Tentativi per fotografare la corona solare senza eclisse. Mem. Spettr. Ital. 24 (1895) 21-30; Astrophys. J. 1 (1895) 18-26; Beibl. (1895) 428.
- , Fotografie della Grande Nebulosa di Orione e della minore presso la stella 42 Orionis. Rend. Accad. Roma (5a) 4 (1895) 341; Beibl. (1895) 203.
- , Sulla duplicità della riga solare  $D_3$ . Astron. Nachr. 138 (1895) 287-288; Astrophys. J. 2 (1895) 236.—See E. E. Hale, *ibid.* 165.
- , Eclisse di luna del 5 settembre 1895. Mem. Spettr. Ital. (1895) 127.
- , Righe spettrali atmosferiche, osservate sull' Etna. Mem. Spettr. Ital. 25 (1896) 127-134; Beibl. (1896) 978.
- et Tacchini. Immagini spettroscopiche del bordo solare designate a Cataniae Roma, 1894. Mem. Spettr. Ital. 25 (1896) maio.
- Richards, Th. W. Note on the spectra of Hydrogen. Chem. News 79 (1899) 159-160.
- Richardson, A. The application of the expansion of chlorine by light to the measurement of the intensity of the rays of high refraction. Phil. Mag. (5) 32 (1891) 277-284; Beibl. (1892) 537.

- Rieke, E.* Zur Dynamik der Serienschwingungen eines Linienspektrums. *Physikal. Ztsch.* 1 (1899) 10.
- Righi, A.* Riflessione della luce polarizzata al polo di una calamita. *Rend. Accad. Roma* 1 (1884) 1-5. *Ann. chim. phys.* (6) 4 (1886) 433; *Jahresb.* (1886) 300.
- —. Neue Erscheinungen an Gittern. *Beibl.* (1887) 539-543.
- —. Sulla misura delle forze elettromotorici di contatto dei metalli in vari gas, per mezzo delle radiazioni ultraviolette. *Rend. Accad. Roma* (1889) 860-862.
- —. Sui fenomeni elettrici provocati dalle radiazioni. *Nuov. Cim.* (3) 25 (1889) 193-211.
- —. Ricerche sperimentali intorno a certe scintille elettriche costituite da massa luminose in moto. *Mem. Accad. Bologna* (5) 1 (1891) 679-709; *Rend. Accad. Roma* 7 (1891) 330-333.
- —. Sulla misura delle differenze di fase prodotte dalle lamine cristalline e sulle costruzione delle lamine quarto d'onda e mezza onda. *Rend. Accad. Roma* (5) 1 (1892) 189-194.
- —. Sulle oscillazioni elettriche a piccola lunghezza d'onda e sul loro impiego nella produzione di fenomeni analoghi ai principali fenomeni dell'ottica. *Nuov. Cim.* (4) 1 (1895) 25-40.
- —. Sulla doppia rifrazione della radiazioni elettriche. *Atti Accad. Roma* 4 (1895) 203-207.
- —. Nuovi studi sulla dispersione elettrica prodotta dai raggi di Röntgen. *Atti Accad. Lincei* 5 (1896) 342-348; *Phil. Mag.* (5) 41 (1896) 230-233.
- —. Sull'assorbimento delle onde elettromagnetiche. *Nuov. Cim.* 5 (1897) 466-470, *C. -R.* 127 (1898) 216-219; *Sitzb. preuss. Akad.* (1898) 600-603.
- —. Sull'interpretazione cinematica del fenomeno di Zeeman. *Rend. Accad. Roma* 7 (1898) 295-302, *Beibl.* (1898) 695.
- —. Di un nuovo metodo sperimentale per lo studio dell'assorbimento della luce nel campo magnetico. *Rend. Accad. Roma* 7 (1898) 41-46, 333-339; *Nuov. Cim.* 8 (1898) 102-109, 295-312.
- —. Sull'assorbimento della luce per parte di un gas posto nel campo magnetico. *Rend. Accad. Bologna* (1899) 27 pp.; *C. -R.* 128 (1899) 45-48; *Beibl.* (1899) 510.
- Rigollot, H.* Sur les spectres d'absorption des solutions de l'iode. *C. -R.* 112 (1891) 38-40, *Beibl.* (1891) 280.
- —. Action des rayons infra-rouges sur le sulfure d'argent. *C. R.* 121 (1895) 164-166; *Beibl.* (1895) 891.

- Ritsert, E.* Phosphorescenz durch Ozonwasser. Beibl. (1890) 984.
- Ritter, A.* The constitution of gaseous celestial bodies. *Astrophys. J.* 8 (1898) 293-315.
- Ritter, R.* Ueber die Reflexion des Lichtes an parallel zur optischen Axe geschliffenen Quarz. *Ann. Phys. n. F.* 36 (1889) 236-264.
- Rive, L. de la.* Sur la théorie des interférences de l'onde électrique propagée dans un fil conducteur et du résonateur. *Arch. de Genève* 23 (1890) 391-401.
- Rizzo, G. B.* Variazioni prodotti dal calore in alcuni spettri d'assorbimento. *Atti Accad. Torino* 26 (1890-1891) 442-448; Beibl. (1891) 715.
- . Le linee telluriche dello spettro solare. *Mem. Spettr. Ital.* 20 (1891) 20 pp.; Beibl. (1891) 645.
- . Sull' estensione della legge di Kirchhoff intorno alla relazione fra l'assorbimento e l'emissione della luce. *Atti Accad. Torino* 29 (1893-1894) 292-301; Beibl. (1894) 835.
- . Intorno all' assorbimento della luce nel platino a diverse temperature. *Atti Accad. Torino* 28 (1893) 465-478; Beibl. (1893) 1059; *Nuov. Cim.* 35 (1894) 22-31.
- . Sulle proprietà delle linee e delle bande negli spettri d'assorbimento. *Nuov. Cim.* 35 (1894) 132-136; Beibl. (1894) 836.
- . Ricerche spettroscopiche sull' argon. *Atti Accad. Torino* 32 (1896-1897) 12 pp.; Beibl. (1898) 666.
- . Misure assolute del calore solare. *Mem. Spettr. Ital.* 26 (1897) 79-93; 27 (1898) 10-32.
- Roberts, A. W.*  $\alpha$  Centauri. *Astron. Nachr.* 139 (1895) 7-11, 11-14, 177-190.
- . Variable Stars. *Astron. J.* 15 (1895) 100, 111, 134, 149; 16 (1896) 97-101, 144, 183-184, 201, 205.
- . Position and proper motion of  $\beta$  Centauri. *Astron. Nachr.* 142 (1896) 51-55.
- . T Centauri. *Mon. Not.* 56 (1896) 347-351, 500.
- Roberts, C.* An observation of Saturn. *Jour. B. A. A.* 5 (1895) 219-220.
- Roberts, Isaac.* Nebulae. *Knowl.* 18 (1895) 182, 207, 232, 253, 20 (1897) 100, 218.
- . Photographs of Nebulae. *Mon. Not.* 55 (1895) 398, 399; 56 (1895) 32-33, 70-71, 378, 380.
- . The relative efficiency of a reflector and of portrait lenses for the delineation of celestial objects. *Mon. Not.* 56 (1896) 372-378.

- Roberts-Austen*, W. C. Metals at high temperatures. *Nature* 45 (1892) 534-541.
- . The rarer metals and their alloys. *Roy. Inst. Gr. Brit.* March 15, 1895. 24 pp.
- Rogers*, F. J. Magnesium as a source of light. *Amer. J. Sci.* (3) 43 (1892) 301-314; *Beibl.* (1892) 606.
- Roiti*, A. Come i raggi X, così pare che si pieghino dietro gli ostacoli i raggi luminosi. *Rend. Accad. Roma* 6 (1897) 29-32.
- . La criptoluminescenza dei metalli. *Rend. Accad. Roma* 7 I (1898) 87-91.
- Röntgen*, W. C. Ueber eine neue Art von Strahlen. *Wurzburg phys. med. Ges.* (1895) 10 pp.; *Nature* 53 (1896) 274-276.
- Rood*, O. N. On the regular or specular reflection of the Röntgen Rays from polished metallic surfaces. *Amer. J. Sci.* (4) 2 (1896) 173-180.
- . Color-vision and the Flicker-Photometer. *Amer. J. Sci.* (4) 8 (1899) 258-261.
- Roscoe*, H. E. Aluminum. *Roy. Inst. Gr. Brit.* May 3, 1889, 14 pp.
- und A. Schuster. Die Spectralanalyse in einer Reihe von sechs Vorlesungen mit wissenschaftlichen Nachträgen. *Braunschweig: Vieweg u. Sohn*, 1890, 466 pp.; *Beibl.* (1890) 856.
- und C. Schorlemmer. Ausführliches Lehrbuch der Chemie. *Braunschweig*, 1877-1892, 6 vols. ill.; *London and New York* (in English, A Treatise on Chemistry), 1878-1892, 9 vols., roy. 8vo illustr.
- Rosenberg*, W. Ueber die Farbe der Körper in Abhängigkeit vom Einfallswinkel der Lichtstrahlen auf die zu beleuchtende Fläche. *J. russ. phys. chem. Ges.* (9) 19 (1887) 477-480; *Beibl.* (1888) 472.
- Rosenthal*, H. Absorption, Emission und Reflexion von Quarz, Glimmer und Glas. *Ann. Phys. n. F.* 68 (1899) 793-800.
- Ross*, W. A. The D-lines spectra flame examined by the blowpipe. *Chem. News* 34 (1876) 212, 226, 237.
- Rosse, The Earl of*. Measures of lunar radiation. *Nature* 43 (1891) 104.
- Rowland*, H. A. On the relative wave-length of the lines of the solar spectrum. *Phil. Mag.* (5) 23 (1887) 257-265; *Amer. J. Sci.* (3) 33 (1887) 182-190; *Beibl.* (1887) 777.
- . Recent progress in the use of concave gratings for spectrum analysis. *Rept. Brit. Assoc.* (1888) 566.
- . Photographic Map of the Normal Solar Spectrum. *Chem. News* 59 (1889) 124-125; *Beibl.* (1889) 682.



- Rowland, H. A.* Table of Standard Wave Lengths. *Phil. Mag.* (5) 27 (1889) 479-484. *Beibl.* (1889) 677.
- — — On the Spectra of the Elements and the Constitution of the Sun. *Rept. Brit. Assoc.* (1890) 751.
- — — Recent Progress in Spectrum Analysis. *Chem. News* 63 (1891) 133-134; *Beibl.* (1891) 513.
- — — Notes on the theory of the Transformer. *Johns Hopkins Univ. Cir.* 2 (1892) 104-105.
- — — Gratings in theory and practice. *Astron. and Astrophys.* 12 (1893) 129-147; *Phil. Mag.* (5) 35 (1893) 397-419; *Beibl.* (1893) 838.
- — — A new table of standard wave-lengths. *Phil. Mag.* (5) 36 (1893) 49-75.
- — — Preliminary Table of Solar Spectrum Wave-Lengths. *Astrophys. J.* 1 (1895) 29-46, 135-145, 222-231, 295-304, 377-392, 2 (1895) 45-54, 109-118, 188-197, 306-315, 360-369; 3 (1896) 141-146, 201-206; 4 (1896) 106-115, 278-287; 5 (1897) 11-25, 109-118, 181-193; 6 (1897) 384-392; published complete by the University Press, Chicago, Ill., 1898, 235 pp.
- — — and *R. R. Tatnall.* The Arc-Spectra of the Elements. I. Boron and Beryllium. II. Germanium. *Astrophys. J.* 1 (1895) 14-17, 149-153; *Beibl.* (1895) 422; (1896) 29.
- — — Ditto, Platinum and Osmium. *Astrophys. J.* 2 (1895) 184-187, *Beibl.* (1896) 365.
- — — Ditto, Rhodium, Ruthenium, and Palladium. *Astrophys. J.* 3 (1896) 286-291.
- — —, *N. R. Carmichael,* and *L. F. Briggs.* Notes of Observations on the Röntgen Rays. *Phil. Mag.* (5) 41 (1896) 381-382; *Amer. J. Sci.* (4) 1 (1896) 247-248.
- — — and *C. N. Harrison.* Arc-Spectrum of Vanadium. *Astrophys. J.* 7 (1898) 273-294.
- — — Arc-Spectrum of Lanthanum. *Astrophys. J.* 7 (1898) 373-389.
- Roy A. F.* New Variable in Virgo. *Astron. J.* 17 (1897) 110.
- Rubens, H.* Selective Reflexion von Metallspiegeln. *Ann. Phys.* n. F. 37 (1889) 249.
- — — Die Anwendung des Bolometers zur quantitativen Messung der Hertz'schen Strahlung. *Verh. d. phys. Ges. Berlin* 9 (1890) 27-31.
- — — Eine Methode zur Bestimmung der Dispersion ultrarother Strahlen. *Verh. d. phys. Ges. Berlin* 10 (1891) 83-84.

- Rubens, H. (Cont'd), und B. W. Snow.* Ueber die Brechung der Strahlen von grosser Wellenlänge in Steinsalz und Fluorit. *Ann. Phys. n. F.* 146 (1892) 529.
- . Dispersion der ultrarother Strahlen im Fluorit. *Ann. Phys. n. F.* 51 (1894) 381.
- . Prüfung der Ketteler-Helmholtz'schen Dispersionsformel. *Ann. Phys. n. F.* 53 (1894) 267–286; 54 (1895) 476–485.
- . Das ultrarote Absorptionsspektrum von Steinsalz und Sylvin. *Verh. d. physikal. Ges. Berlin* 15 (1896) 108–110; *Beibl.* (1897) 130.
- und *E. F. Nichols.* Ueber Wärmestrahlen von grosser Wellenlänge. *Naturwiss. Rundschau* 11 (1896) 545–549; *Ann. Phys. n. F.* 60 (1897) 418–462.
- . Wärmestrahlen von grosser Wellenlänge. *Verh. d. Ges. deutscher Naturf. u. Aerzte* II 1 (1897) 54–56.
- and *E. F. Nichols.* Certain optical and electro-magnetic properties of heat-waves of great wave-length. *Phys. Rev.* 5 (1897) 98–112, 152–169.
- und *A. Trowbridge.* Beiträge zur Kenntniss der Dispersion und Absorption der ultraroten Strahlen in Steinsalz und Sylvin. *Ann. Phys. n. F.* 60 (1897) 724–739.
- und *E. Ashkinass.* Absorption und Emission von Wasserdampf und Kohlensäure im infraroten Spektrum. *Ann. Phys. n. F.* 64 (1898) 1; *Astrophys. J.* 1 (1898) 176–192.
- , ———. Absorption und Emission von Wasserdampf und Kohlensäure im ultravioletten Spektrum. *Ann. Phys. n. F.* 64 (1898) 584–601.
- , ———. Die Durchlassigkeit einiger Flüssigkeiten für Wärmestrahlen von grosser Wellenlänge. *Ann. Phys. n. F.* 64 (1898) 602–605.
- , ———. Die Reststrahlen von Steinsalz und Sylvin. *Ann. Phys. n. F.* 65 (1898) 241–256; *Verh. d. phys. Ges. Berlin* 17 (1898) 42–45.
- , ———. Isolirung langwelliger Wärmestrahlen durch Quarzprismen. *Verh. deutsch. phys. Ges.* 1 (1899) 11–12.
- Rücker, A. W.* Thickness and Refractive Power. *Phil. Mag.* (5) 28 (1889) 271.
- Rümker, G.* Positionsbestimmungen von Nebelflecken und Sternhaufen. *Mittheil. d. Hamburger Sternwarte*, No. 1, 1893.
- Rummel, L.* The spectra of the alkalies and their atomic weights. *Proc. Roy. Soc. Victoria* (1896) 260–263; (1897) 75–78; *Beibl.* (1897) 973.



- Runge, C.* The Harmonic Series of lines in the spectra of the elements. Rept. Brit. Assoc. (1888) 576; Beibl. (1890) 509.
- . Ueber eine Methode zur Unterscheidung wahrer von zufälliger Coincidenzen zwischen den Linien verschiedener Spectra. Phil. Mag (5) 29 (1890) 462-466; Beibl. (1890) 781.
- and *G. F. Stoney*. The Line-Spectra of the Elements. Nature 46 (1892) 29, 100, 126, 200, 222, 247, 268; Beibl. (1894) 559.
- . On a certain law in the spectra of some elements. Astron. and Astrophys. 13 (1894) 128-130, Beibl. (1895) 173.
- und *F. Paschen*. Die Bestandtheile des Cleveite-Gases. Sitzb. Berliner Akad. 34 (1895) 759-763; Phil. Mag. (5) 40 (1895) 297-303; Astrophys. J. 3 (1896) 4-28.
- . Terrestrial Helium(?). Chem. News 71 (1895) 283; Beibl. (1895) 634.
- und *F. Paschen*. Das Spektrum des Heliums. Sitzb. Berliner Akad. (1895) 639-643; Beibl. (1895) 884.
- , ———. Helium and the Spectrum of Nova Aurigae. Nature 52 (1895) 544.
- , ———. Crookes's Spectrum of Helium. Nature 53 (1895) 245; Beibl. (1897) 633.
- , ———. Die Wellenlängen der ultravioletten Aluminiumlinien. Ann. Phys. n. F. 55 (1895) 44-48; Astrophys. J. 1 (1895) 433.
- , ———. Oxygen in the Sun. Astrophys. J. 4 (1896) 317-319; Beibl. (1897) 518.
- , ———. Ueber die Serienspektren der Elemente; Sauerstoff, Schwefel und Selen. Ann. Phys. n. F. 61 (1897) 641-686; Chem. News 76 (1897) 255-256, Astrophys. J. 8 (1898) 70-101.
- , ———. Origin of the Aurora Spectrum. Nature 59 (1898) 29.
- , ———. The relative intensities of the lines in the spectrum of the Orion Nebula. Astrophys. J. 8 (1898) 32-36.
- , ———. The red end of the red Argon spectrum. Astrophys. J. 9 (1899) 281-284.
- Ruoss, H.* Bestimmung des Brechungsexponenten für Flüssigkeiten durch Spiegelablesung mit Fernrohr und Skala. Ann. Phys. n. F. 48 (1893) 531.
- Russell, H. N.* The Atmosphere of Venus. Astrophys. J. 9 (1899) 284-299; Beibl. (1899) 787.
- Russell, S. M.* Some astronomical records of ancient Chinese books. Observ'y 18 (1895) 430-433.
- Russell, W. F., and W. Lapraik*. The absorption spectra of uranium salts. Rept. Brit. Assoc. (1886) 576-577; Beibl. (1887) 822.

- Russell, W. J.* (*Cont'd*), and *W. J. Orsman*. The relation of cobalt to iron as indicated by absorption spectra. *Chem. News* 59 (1889) 93-94; *Beibl.* (1896) 535.
- Rutherford, E.* A magnetic detector of electrical waves. *Proc. Roy. Soc.* 60 (1896) 184-186.
- . The discharge of electrification in ultra-violet light. *Cambridge Phil. Soc. Proc.* 9 (1898) 401-417; *Beibl.* (1898) 895.
- Rydberg, J. R.* Constitution der Emissionsspectra der chemischen Elemente. *Svensk Akad. Handl.* 23 (1890) 155; *Beibl.* (1891) 351.
- . Ueber den Bau der Linienspectren der chemischen Grundstoffe. *Ztsch. phys. Chem.* 5 (1890) 227-232; *Phil. Mag.* (5) 29 (1890) 331-337; *C.-R.* 110 (1890) 394-397.
- . Beiträge zur Kenntniss der Linienspectren. *Ann. Phys. n. F.* 50 (1894) 119; *Oefvers. Akad. Stockholm* (1893) 677-693; *Astrophys. J.* 1 (1890) 90, abs.
- . Eine neue Methode zur Bestimmung der Dispersion der Luft. *Oefvers Akad. Stockholm* 50 (1893) 693-697; *Beibl.* (1895) 486.
- . A certain asymmetry in Prof. Rowland's Gratings. *Bih. till Akad. Handl. Stockholm* 18 (1893) No. 9; *Beibl.* (1893) 840; *Phil. Mag.* (5) 35 (1893) 190-199.
- . Studien über das System der Spektralserien. *Verh. d. Ges. deutsch. Naturf. u. Aerzte* 2 I (1896) 34, II (1896) 53.
- . Die neuen Grundstoffe des Cleveitgases. *Ann. Phys. n. F.* 58 (1896) 674-679; *Astrophys. J.* 4 (1896) 91-96.
- . Eine einfache Methode, periodische Fehler zu bestimmen. *Ztsch. f. Instrum.* 16 (1896) 227-233.
- . The New Series in the Spectrum of Hydrogen. *Astrophys. J.* 6 (1897) 233-238; *Beibl.* (1898) 153.
- . Triplets with constant differences in the line of spectrum of copper. *Astrophys. J.* 6 (1897) 239-243; *Beibl.* (1898) 153.
- . On the constitution of the red spectrum of Argon. *Astrophys. J.* 6 (1897) 338-348; *Beibl.* (1898) 154.
- . Metargon and the Interplanetary Medium. *Nature* 58 (1898) 319; *Beibl.* (1899) 395.
- . Grundzüge einer Kometentheorie. *Beibl.* (1899) 99; *Kgl. Fysiograf. Sällsk. Handl.* 9 (1898) No. 5, 48 pp.

## S

- Sabatier, P.* Spectres d'absorption des chromates alcalins et de l'acide chromique. C.-R. 103 (1886) 49-53; Chem. News 54 (1886) 44; Beibl. (1887) 223.
- —. Spectres d'absorption des chromates alcalins et de l'acide chromique. Ann. de Toulouse I D (1887) 11 pp.; Beibl. (1888) 194.
- —. Sur le sulfure de bore. C.-R. 112 (1891) 862-864.
- —. Spectres d'absorption du bromure cuivrique. C.-R. 118 (1894) 980-982, 1042-1043, 1144-1146; Ann. Phys. Beibl. (1894) 757, 838.
- —. Sur un bromhydrate de bromure cuivrique et sur un bromure rouge et de potassium. C.-R. 118 (1894) 1260-1263; Beibl. (1894) 1048.
- — et *J. B. Senderens*. Action du nickel sur l'éthylène. C.-R. 124 (1897) 616-618.
- Sachs, J. von*. Die Wirkung der ultravioletten Strahlen auf die Blütenbildung. Arbeiten d. botan. Instit. Würzburg 3 (1887) 372-388; Beibl. (1888) 105.
- —. Die spezifische Lichtabsorption des gelben Flecks der Netzhaut. Pflüger's Archiv 50 (1891) 574-586; Beibl. (1893) 658.
- Sagnac, G.* Les expériences de M. H. Becquerel sur les radiations invisibles émises par les corps phosphorescents et par les sels d'uranium. J. de phys. (3) 5 (1896) 193-202.
- —. Sur les propriétés des gaz traversés par les rayons X et sur les propriétés des corps luminescents ou photographiques. C.-R. 125 (1897) 168-171.
- —. Sur la transformation des rayons par les différents corps simples. Soc. franc. de phys. (1899) 1.
- —. Émission de différents rayons inégalement absorbables dans la transformation des rayons X par un même corps. C.-R. 128 (1899) 300-303.
- Saija, G.* Sulla scelta dell' orologio campione. Mem. Spettr. Ital. 28 (1899) 19-22.
- St. Dunstan, A., M. E. Rice, and C. A. Kraus*. Broadening of sodium lines by intense magnetic fields. Amer. J. Sci. (4) 3 (1897) 472-475; Kansas Univ. Quar. 4 (1897) 77-88.
- St. John, Ch. E.* Wave-lengths of electricity on iron wires. Phil. Mag. (5) 38 (1894) 425-441; Amer. J. Sci. (3) 48 (1894) 311-325.

- St John Ch. E. (Cont'd).* Vergleichung des Licht emissionsvermögens der Körper bei hohen Temperaturen, und über den Auer-schen Brenner. *Ann. Phys. n. F.* 56 (1895) 433-450.
- St. Meunier* Analyse de la météorite tombée à Madrid. *Bull. Soc. astron. France* (1896) 122-123.
- Salet G.* Sur la flamme bleue du sel commun et la réaction spectroscopique du chlorure de cuivre. *C.-R.* 110 (1890) 282-283; *Beibl* (1890) 511.
- . *Traité élémentaire de Spectroscopie.* Paris: G. Masson 1888.
- Salomons, D.* Some new phenomena in vacuum tubes. *Proc. Roy. Soc.* 56 (1894) 229-250.
- . Incandescent lamps. *Chem. News* 72 (1895) 116.
- Salvioni, E.* Un metodo per confrontare gli schermi fluorescenti ai raggi X. *Atti Accad. Perugia* 8 (1896) 18 pp.; *Nuov. Cim* 5 (1897) 63-70.
- Sandrucci, A.* Fosforescenza del vetro ed emissione di raggi catodici cessata l'azione eccitatrice del tubo. *Nuov. Cim.* 6 (1897) 322-325.
- . Emissione contemporanea di raggi ortocatodici da ambedue gli elettrodi e proprietà della luce violacea nei tubi del Crookes. *Rend. Accad. Lincei* (5) 7 (1898) I 100-108.
- Sartorio, G. W.* Osservazioni solari eseguite nel Reale Osservatorio di Palermo. *Mem. Spettr. Ital.* 24 (1895) 133; 25 (1896) 65-81.
- Saunders, F. A.* Absorption of ice in the Ultra-Red. *Johns Hopkins Univ. Cir.* 18 (1899) 58-59.
- Saussure, R. de.* *Theorie des phénomènes physiques et chimiques.* *Arch. de Geneve* 25 (1891) 105-128, 170-193.
- Savelief, R.* Ueber die in Kief angestellten Actinometerbeobachtungen. *C.-R.* 108 (1889) 287-289; *Beibl* (1889) 503.
- . Résultats des observations actinométriques faites à Kiew en 1888-1889. *C. R.* 118 (1890) 235-237; *Beibl* (1890) 786.
- . Determination de la constante solaire. *Ann. chim. phys.* (6) 25 (1892) 567-574; *C.-R.* 112 (1891) 1200-1202; *Beibl* (1891) 645.
- . Sur le degré de précision qu'on peut atteindre dans les obscurations actinométriques. *Ann. chim. phys.* (6) 29 (1893) 260-283, (7) 4 (1895) 424-429.
- Sawyer, E. F.* On variable stars. *Astron. J.* 14 (1895) 189-191, 16 (1896) 48, 82-84, 113-117; 17 (1896) 3-4, 115-116.
- Schaeberle, J. M., and J. N. Lockyer.* The Sun's Corona. *Nature* 44 (1891) 300-301.

- Schaeberle, J. M.* Terrestrial atmospheric absorption of the photographic light-rays. Contributions of the Lick Observatory, No. 3, 1893, 89 pp.; Beibl. (1893) 650.
- . A cometary structure in the Corona of April 16, 1893. Astron. and Astrophys. 13 (1894) 304-308.
- . Report on the total eclipse of the sun, observed at Mina Bronces, Chile, April, 16, 1893. Lick Observ. Contrib. 4 (1895) 126 pp.; Beibl. (1896) 198.
- . Observations of the spectrum of the Orion Nebula. Astrophys. J. 6 (1897) 364-365.
- Schneider, J.* Die Bestimmung der Sterngrößen aus photographischen Aufnahmen. Astron. Nachr. 121 (1889) 49-62; Beibl. (1889) 886.
- . Photographische Aufnahmen von Sternspectren. Astron. Nachr. 122 (1889) 321-344; Beibl. (1889) 949.
- . Untersuchungen über die Sternspectra von I. Typus auf Grund von photographischen Aufnahmen. Sitzb. Berliner Akad. 8 (1890) 143-151; Beibl. (1890) 514.
- . Bestimmung von Sterngrößen aus photographischen Aufnahmen. Astron. Nachr. 124 (1890) 273-278; Beibl. (1891) 208.
- . Apparat zur Verbreiterung von photographischen Sternspectrum. Astron. Nachr. 124 (1890) 279-282; Beibl. (1891) 207.
- . Photographisch-photometrische Untersuchungen. Astron. Nachr. 128 (1891) 113-122; Beibl. (1894) 103.
- . Verbreiterung der photographischen Sternscheibchen. Astron. Nachr. 133 (1893) 73-80; Beibl. (1894) 104.
- und *S. Hirayama*. Photographische Aufnahmen Fraunhofer'schen Beugungsfiguren. Sitzb. Berliner Akad. (1894) 433-442; Beibl. (1895) 338.
- . Neuere Spektroskopkonstruktionen. Ztsch. f. Instrum. 14 (1894) 316-325; Beibl. (1894) 1045.
- . Die Spectralanalyse der Gestirne. Leipzig: W. Engelmann 1890, 474 pp.; revised and enlarged by E. B. Frost under the title: A Treatise on Astronomical Spectroscopy, Boston: Ginn & Co., 1894, 482 pp.; Astrophys. J. 2 (1895) 308-311.
- . Ursache der Granulation der Sonnenoberfläche. Astron. Nachr. 137 (1895) 229-232; Beibl. (1896) 198; Astrophys. J. 2 (1895) 77-80.
- . Untersuchung über die Spectra der helleren Sterne nach photographischen Aufnahmen. Pub. Astron. Observ. Potsdam 7 II (1897) 171-335; Beibl. (1898) 362-363.

- Schrauf, A.* (Cont'd) Die optische Constanten des prismatischen Schwetels bei verschiedenen Temperaturen. Ztsch. f. Kryst. u. Min. 18 (1890) 113-173; Beibl. (1891) 37; Wiener Anzeiger (1890) 105-106.
- Schulz, F. H.* Zur Sonnenphysik. Astron. Nachr. 118 (1889) Nos. 2717-2718; 119 (1889) Nos. 2747-2748, Beibl. (1889) 505-507.
- Schumann, V.* Latest Research on the Photography of Metallic Spectra. Chem. News 62 (1890) 299; Beibl. (1891) 205.
- Photographische Gesamtaufnahme des Spectrums zwischen den Wellenlängen 760 und 200  $\mu\mu$ . Eder's Jahrb. 4 (1890) 158-163, Beibl. (1890) 615.
- Photographie der brechbarsten Strahlen. Photogr. Rundsch. 4 (1890) 71-80; Beibl. (1890) 1095.
- On determining the sensitiveness of photographic plates by means of the spectrograph. Chem. News 63 (1891) 33-34; Beibl. (1891) 281.
- Vacuumphotography. Chem. News 64 (1891) 275, Beibl. (1892) 278.
- Eine neue ultraviolett empfindliche Platte und die Photographie der Lichtstrahlen kleinster Wellenlängen. Wiener Anzeiger (1892) 231.
- Ueber ein unbekanntes Lichtgebiet von grosser photographischer Energie. Photogr. Rundsch. (1892) 33 pp.
- Zur Photographie der Lichtstrahlen kleinster Wellenlängen vom Luftspectrum jenseits 152.2  $\mu\mu$ . Sitzb. Wiener Akad. 102 II (1893) 415-475, 625-694; Beibl. (1894) 187; Wiener Anzeiger 24-30, 131.
- Ein neues Verfahren zur Herstellung ultraviolett empfindlicher Platten. Sitzb. Wiener Akad. 102 II a (1893) 994-1024; Beibl. (1894) 456.
- Die Wasserstofflinie H $\beta$  im Spectrum des neuen Sterns im Fuhrmann und im Spectrum von Vacuumrohren. Astron. and Astrophys. 12 (1893) 159-166; Beibl. (1893) 826.
- Das Absorptionsspectrum des Bromsilbers bei steigender Temperatur. Jahresb. f. Photogr. (1893) 160-165; Beibl. (1893) 1030.
- Vom Wasserstoffspectrum. Jahrb. f. Photogr. 8 (1894) 59; Beibl. (1894) 752.
- Von den brechbarsten Strahlen und ihrer photographischen Aufnahme (vierte Folge). Jahrb. f. Photogr. 9 (1895) 198-201; 10 (1896) 42-45; Beibl. (1896) 648, 975.



- Schumann, V.* On a new method of preparing plates sensitive to the ultra-violet rays. *Astrophys. J.* 3 (1896) 220-226. 387-394; 4 (1896) 144-155.
- . Ueber den Einfluss einer unsymmetrischen, veränderlichen Refraction auf die Polhöfenschwenkung. *Astron. Nachr.* 141 (1896) 81-83.
- . Von den brechbarsten Strahlen und ihrer photographischen Aufnahme. *Jahrb. f. Photogr.* 11 (1897) 20-22, 24-25; Beibl. (1897) 839, 973.
- . Von den brechbarsten Strahlen und ihrer photographischen Aufnahme. *Eder's Jahrb.* 12 (1898) 20; Beibl. (1898) 841.
- Schunck, C. A.* Quantitative investigation of the absorption spectrum of the blue potassium chromium oxalate. *Chem. News* 51 (1885) 155, abs.; read before the Chem. Phys. Soc. London, March 19, 1885.
- and *Marchlewski.* Absorption Spectra of Chlorophyll Colours. *Proc. Roy. Soc.* 59 (1896) 235.
- A photographic investigation of the absorption spectra of Chlorophyll and its derivatives in the Violet and Ultra-Violet region of the Spectrum. *Proc. Roy. Soc.* 63 (1898) 389-396; Beibl. (1898) 776.
- . The yellow colouring matters accompanying Chlorophyll and their spectroscopic relations. *Proc. Roy. Soc.* 65 (1899) 177-186.
- Schur, W.* Helligkeitsschätzungen von T (nova) Aurigae. *Astron. Nachr.* 138 (1895) 109-111.
- . Beobachtungen der veränderlichen Sterne  $\delta$  Cephei,  $\eta$  Aquilae und  $\beta$  Lyrae. *Astron. Nachr.* 137 (1895) 297-329.
- . Determination of the diameter and compression of the planet Mars from observations with the Repsold heliometer of the Royal Observatory, Göttingen. *Mon. Not.* 57 (1897) 150-151.
- Schuster, A.* On Harmonic Ratios in the Spectra of Gases. *Proc. Roy. Soc.* 31 (1880-1881) 337.
- . Experiments with Lord Rayleigh's Colour Box. *Proc. Roy. Soc.* 48 (1890) 140-149; Beibl. (1890) 1107.
- . The elementary treatment of refraction problems. *Phil. Mag.* (5) 31 (1891) 77-86; Beibl. (1891) 561.
- . Ya-t-il de l'oxygène dans l'atmosphère du Soleil? *C.-R.* 118 (1894) 137-138; Beibl. (1894) 6562. —See Dunér *C.-R.* 117 (1893) 1056-1059.

- Schuster, A. (Cont'd).* On interference phenomena. *Phil. Mag.* (6) 37 (1894) 509-546; *Beibl.* (1894) 999.
- . Sur les spectres cannelés. *C.-R.* 120 (1895) 987-989; *Beibl.* (1895) 788.
- and *Lord Rayleigh.* A discussion "On the evidence to be gathered as to the simple or compound character of a gas, from the constitution of its spectrum." *Rept. Brit. Assoc.* (1895) 610.
- . On a new law connecting the periods of molecular vibrations. *Nature* 55 (1896) 200, 223.
- . La lumière zodiacale. *Bull. Soc. Belge d'Astron.* 1 (1896) 55-66.
- . Prof's C. Runge and F. Paschen's researches on the spectra of oxygen, sulphur, and selenium. *Nature* 57 (1897) 320-321; *Beibl.* (1898) 400.
- . Constitution of the electric spark. *Rept. Brit. Assoc.* (1897) 557-559.
- . The spectrum of Metargon. *Nature* 58 (1898) 199-269; *Beibl.* (1898) 513, 772.
- and *G. Hemsalech.* The constitution of the electric spark. *Chem. News* 79 (1899) 62-64; *Proc. Roy. Soc.* 64 (1899) 331-336.
- Schütt, F.* Das spezifische Brechungsvermögen von Na Cl. *Ztsch. phys. Chem.* 5 (1890) 349; *Jahresb.* (1890) 387.
- . Die Bestimmung der Molecularrefraction fester chemischer Verbindungen in Lösungen derselben, II. Abhandl. *Ztsch. phys. Chem.* 9 (1892) 349-377; *Beibl.* (1892) 735.
- . Astronomical Photography (in 1895). *Mon. Not.* 56 (1896) 278-281.
- . Innere Bau und optisches Verhalten der Lippmann'schen Photographien in natürlichen Farben. *Ann. Phys. n. F.* 57 (1896) 533-554.
- Schutze, M.* Zusammenhang zwischen Farbe und Constitution der Verbindungen. *Ztsch. phys. Chem.* 9 (1892) 109-136; *Beibl.* (1892) 428.
- Schwarzschild, K.* Messung von Doppelsternen durch Interferenzen. *Astron. Nachr.* 139 (1896) 353-360; *Beibl.* (1897) 344.
- . Zur Bestimmung der Theilungsfehler von Maasstäben. *Astron. Nachr.* 143 (1897) 1-11.
- Schweinitz, E. A. de.* Meteorite from Forsythe County, North Carolina. *Amer. J. Sci.* (4) 1 (1896) 208.
- Sczelchow.* Spectrophotometrie des Blutes. *Pflüger's Archiv f. Physiol.* 41 (1888) 373; *Jahresb.* (1888) 2413.



- Scarle, A.* Preservation of the Solar Energy in the Atmosphere. Proc. Amer. Acad. (1888) 26-29; Beibl. (1889) 219.
- — — Beobachtungen über das Zodiakallicht, angestellt am Harvard College Observatory. Astron. Nachr. 124 (1890) 405-408.
- — — Eine mögliche secundäre Ursache des Phänomens des Gegenscheines. Astron. Nachr. 126 (1890) 115; Beibl. (1891) 646.
- See, T. F. F.* History of the colour of Sirius. Astron. and Astrophys. (1892) 269-274.
- — — Neue Wahrnehmungen am Mondkrater Linné. Sirius 23 (1895) 50-56; Amer. J. Sci. (4) 15 (1895) 38.
- — — Theorie der Bestimmung der absoluten Dimensionen, Massen und Parallaxen von Sternsystemen, deren Bahnen aus mikrometrischen Messungen ermittelt sind, durch eine einzelne spectroscopische Messung nebst einer strenger Methode zur Prüfung der universellen Gültigkeit des Gravitationsgesetzes. Astron. Nachr. 139 (1895) 17-26, 161-164; Beibl. (1896) 371; (1897) 344; Astrophys. J. 3 (1896) 232-234, abs.
- — — Die theoretische Möglichkeit, die Distanzen von Sternhaufen und der Milchstrasse zu bestimmen und die Struktur des Himmels durch wirkliche Messungen zu untersuchen. Astron. Nachr. 139 (1895) 161-164; Beibl. (1897) 344; Astrophys. J. 3 (1896) 232-234.
- — — The magnitude of the variable star  $\eta$  Carinae in 1897. Astron. J. 17 (1897) 119.
- Seeliger, H.* Zur Theorie der Beleuchtung der grossen Planeten, insbesondere des Saturn. Sitzb. d. Bayer. Akad. 16 II (1887) 114 pp.; Beibl. (1887) 356.
- — — Zur Photometrie zerstreut reflectirender Substanzen. Sitzb. Münchener Akad. (1888) 201-248.
- — — Notiz über die Strahlenbrechung in der Atmosphäre. Sitzb. Münchener Akad. 21 (1891) 239-246; Beibl. (1894) 78.
- — — Extinction des Lichtes in der Atmosphäre. Sitzb. Münchener Akad. 21 (1891) 247-272; Beibl. (1894) 88.
- — — Zusammenstösse und Theilungen planetischer Massen. Abhandl. d. Bayer. Akad. 17 (1891) 459-490; Beibl. (1891) 353.
- — — Ueber den neuen Stern im Sternbilde Auriga. Astron. Nachr. 130 (1892) 393-406; Beibl. (1894) 102.
- — — Bemerkung über die Rotation des Saturnringes. Astron. Nachr. 138 (1895) 99-101, 416-427; Beibl. (1896) 38.
- Seguy, G.* Radiometer und Photometer. Ztsch. f. Instrum. 13 (1893) 430; Beibl. (1894) 189; (1895) 629; C.-R. 120 (1895) 629.

- Seguy, G. (Cont'd).* Un phénomène de phosphorescence obtenu dans des tubes contenant de l'azote raréfié après le passage de la décharge électrique. C.-R. 121 (1895) 198-199.
- — et *E. Gundelag.* Une nouvelle ampoule bianodique à phosphorescence rouge. C.-R. 125 (1897) 602-603.
- Sella, A.* Sulla variazione dell' indice di rifrazione dell' diamante colla temperatura e su di una generalizzazione del metodo di minima deviazione col prisma. Rend. Accad. Roma 7 (1891) 300-308; Beibl. (1892) 423.
- —. Sulle leggi di propagazione della luce nei cristalli magnetici. Atti Accad. Roma 4 (1895) 237-242, 283-289.
- — e *Q. Majorana.* Azione dei raggi Röntgen e della luce ultravioletta sulla scarica esplosiva nell' aria. Atti Accad. Roma 5 (1896) 323-327, 389-392; Nuov. Cim. (4) 3 (1896) 238-241.
- Sells, E. P.* Physical observations of Jupiter made at the Adelaide Observatory 1884-1893. Mon. Not. 57 (1897) 152-154.
- Settschenow, T.* Die Absorptionscoefficienten der Kohlensäure in den zu diesem Gase indifferenten Salzlösungen. Mem. Acad. St. Petersb. 34 (1886).
- Sharp, C. H., and W. R. Turnbull.* A bolometric study of light standards. Phys. Rev. 2 (1894) 1-35; Beibl. (1895) 170.
- — —. A method for the use of standard candles. Phys. Rev. 3 (1896) 458-470; Beibl. (1896) 772.
- Shdanko, A.* La détermination du coefficient de la réfraction terrestre. (In Russian.) Compt. rend. Soc. astron. Russe 1 (1896) 33-42.
- Shea, D.* Zur Brechung und Dispersion des Lichtes durch Metallprismen. Ann. Phys. n. F. 47 (1892) 177.
- Shedd, J. C.* An interferometer study of radiations in a magnetic field. Phys. Rev. 9 (1899) 1-20, 86-116.
- Sherman, O. T.* The atmosphere of  $\beta$  Lyrae. Amer. J. Sci. (3) 33 (1887) 126-129; Beibl. (1888) 50.
- Sidersky, D.* Constantes physiko-chemiques. Paris: Gauthier-Villars 1898.
- Sidgreaves, W.* Physical constitution of the Sun. Astron. and Astrophys. 12 (1893) 826-834.
- —. Results of meteorological, magnetical, and solar observations. Stonyhurst Coll. Observ. (1894) 84 pp.; (1895) 80 pp.
- — *Mr. Maunder, Mr. Newall, Mr. McClean, and Prof. Alexander Herschel.* On the modes of printing maps of spectra. Astrophys. J. 5 (1897) 216.

- Sieben, G. Die Abhängigkeit der Brechungsexponenten anomal dispergirender Medien von der Concentration der Lösung und der Temperatur. *Ann. Phys. n. F.* 23 (1884) 312.
- Sierstema, L. H. Metingen over de magnetische draaungsdispersie in gassen. *Zittingsversl. Akad. Wet. Amsterdam* 7 (1898) 289-297.
- — — Mesures de la polarisation rotatoire de l'oxygene et d'autres gaz, dans diverses parties du spectre visible, et détermination de la constante de rotation magnétique de l'eau pour la raie D du sodium. *Archiv. néerland.* 2 (1899) 291-380; *Beibl.* (1899) 384-385.
- Sieghoff, F. G. A. Verklaring van het door Dr. Zeeman gevonden lichtverschijnsel in het oog. *Zittingsversl. Akad. Amsterdam* V (1896-1897) Jan.
- Silow, P. Vereinfachung der Huyghen'schen Konstruktion für die Reflexion und Brechung der Lichtwellen. *Beibl.* (1897) 223.
- Simon, E. Einfluss der Strahlen grosser Brechbarkeit auf das elektrische Leitungsvermögen verdünnter Gase. *Sitzb. Wiener Akad.* 104 II (1895) 565-593.
- Simon, H. Th. Dispersion ultravioletter Strahlen. *Ann. Phys. n. F.* 53 (1894) 542.
- — — Ein neues photographisches Photometrirverfahren und seine Anwendung auf die Photometrie des ultravioletten Spectralgebietes. *Ann. Phys. n. F.* 59 (1896) 91-115; *Astrophys. J.* 5 (1897) 69.
- Simonoff. Einrichtung zur Abschätzung der Helligkeit des Lichtes. *Beibl.* (1894) 337.
- Simony, O. Das Sonnenspectrum und dessen ultraviolette Fortsetzung. *Beibl.* (1892) 152.
- — — Periodische Aufnahmen des Sonnenspektrums vom Gipfel des Pikes von Teneriffa (3711 m.). *Verh. Ges. deutsch. Naturf. u. Aerzte II. Teil* 1 (1895) 85.
- Sirks, J. L. Interferenzerscheinungen in dünnen Blättchen bei senkrechter Reflexion. *Beibl.* (1894) 457, 458.
- — — The astigmatism of Rowland's Concave Gratings. *Verh. k. Akad. Wet.* 2 (1894) 1; *Astron. and Astrophys.* 13 (1894) 763-768.
- Skinner, A. N. New variables. *Astron. J.* 15 (1895) 135, 182.
- Sluginoff, N. Zur Theorie der Reflexion und Brechung des Lichtes. *J. russ. phys. chem. Ges.* 23 (1891) 427-430.

- Smith, A. P.* The violet flame produced by common salt in a coal fire. *Chem. News* 61 (1890) 292-293.—See *G. Salet, C.-R.* 110 (1890) 282.
- Smith, C. M.* The absorption spectra of certain vegetable colouring matters. *Proc. Roy. Soc. Edinburgh* 17 (1889-1890) 121-127; *Beibl.* (1890) 619.
- . The Spectrum of the Zodiacal Light. *Nature* 42 (1890) 22; 43 (1891) 22; *Beibl.* (1891) 205.
- . Phosphorescirendes Schwefelcalcium. *Beibl.* (1893) 1070.
- Smithells, A., and H. Ingle.* On the structure and chemistry of flames. *J. Chem. Soc.* 61 (1892) 204-217, 217-226; *Beibl.* (1892) 361; *Chem. News* 66 (1892) 139-140.
- . Flame. *Nature* 49 (1893) 86-92, 149-150.
- . The Luminosity of Gases. *Phil. Mag.* (6) 37 (1894) 245-259; *Beibl.* (1895) 68; *Astrophys. J.* 1 (1895) 266.
- and *F. Dent.* The structure and chemistry of the cyanogen flame. *J. Chem. Soc.* 55-56 (1894) 603-611; *Beibl.* (1895) 60.
- . The luminosity of gases. III, Experiments on the flame spectra of the salts of copper and gold. *Phil. Mag.* (5) 39 (1895) 122-134; *Beibl.* (1895) 243.
- . Flame temperatures and the acetylene theory of luminous hydrocarbon flames. *J. Chem. Soc.* 67-68 (1895) 1049-1062, 1149-1163; *Chem. News* 72 (1895) 265; *Beibl.* (1896) 367.
- . The source of light in flames. *Roy. Inst. Gt. Brit.* March 12, 1897, 9 pp.
- *H. M. Dawson, and H. A. Wilson.* The electrical conductivity and luminosity of flames containing vaporized salts. *Proc. Roy. Soc.* 64 (1898) 142-148.
- Smolan, M. R.* Smoluchowski de. Etherion, a new gas. *Nature* 59 (1898) 223-224.
- . Neuere Untersuchungen über die Wärmeleitung in Gasen. *Chem. Centralbl.* 2 (1899) 353.
- Smyth, C. P.* Re-examination of the spectra of twenty-three gas-vacuum end-on tubes, after six to ten years of existence and use. *Chem. News* 60 (1889) 223-224; *Beibl.* (1890) 119.
- . Photography of the Invisible in Solar Photography. *Rept. Brit. Assoc.* (1890) 750-751; *Beibl.* (1892) 279.
- . Report of the Committee on Investigations of the Ultra-violet Rays of the Solar Spectrum. *Rept. Brit. Assoc.* (1891) 147; (1892) 74-76.

- Smyth, C. P.* Comparison of Eye and Hand Registration of Lines in the Violet and Ultra-Violet of the Solar Spectrum, against Photographic Records of the Same, with the same instrument after a lapse of several years. Rept. Brit. Assoc. (1891) 573.
- Snow, B. W.* Ueber das ultra-rothe Emissionsspectrum der Alkalien. Ann. Phys. n. F. 47 (1892) 208.
- — —. The continuous spectrum of the alkalies. Proc. Amer. Assoc. (1893) 79-80.
- — —. The infra-red spectra of the alkalies. Phys. Rev. 1 (1893) 221-223; Beibl. (1894) 912.
- — —. The continuous spectrum of sodium. Phys. Rev. 1 (1893) 290-298; Beibl. (1894) 997.
- Sommerfeld, A.* Diffractionsprobleme in exacter Behandlung. Verh. Ges. deutsch. Naturf. u. Aerzte II 1 (1896) 34-35.
- Soret, C.* Quelques phénomènes de réflexion totale, qui paraissent dépendre d'une altération des surfaces. Arch. de Genève (3) 26 (1891) 54-569.
- — — *A. Borcl, et E. Drumont.* Sur les indices de réfraction des solutions bleues et vertes d'aluns de chrome. Arch. de Genève (3) 3 (1897) 376-381; Beibl. (1897) 731.
- — —. Influence des vagues sur la lumière réfléchie par une nappe d'eau. Arch. de Genève (4) 4 (1897) 530-540; Beibl. (1898) 563.
- Soret, J. L.* Absorption des rayons ultra-violets. Arch. de Genève (3) 18 (1887) 344-346; Beibl. (1888) 246.
- — —. Sur la transparence de l'atmosphère. Arch. de Genève 20 (1888) 591-593; Beibl. (1889) 495.
- — — et *E. Sarasin.* Le pouvoir de réfraction de l'eau de mer. C.-R. 108 (1889) 1248.
- — — et *A. A. Kulliet.* L'absorption des rayons ultra-violets par quelques substances organiques faisant partie de la série grasse. C.-R. 110 (1890) 137-139; Arch. de Genève (3) 23 (1890) 5-69; Beibl. (1890) 373.
- Spaulden, E.* Das Auer-Gasglühlicht. Photogr. Mittheil. 30 (1893) 38-40.
- — —. Karbidgas und Wassergasglühlicht. Photogr. Mittheil. 32 (1895) 6 11.
- Spee, E.* Les spectres de diffraction. Bull. Acad. Belg. (3) 12 (1886) 439; Beibl. (1887) 786.
- — —. Projet d'une spectroscopie réalisant le phénomène d'une éclipse totale du Soleil. Bull. Acad. Roy. Belg. (3) 30 (1895) 274-276.

- Spec, E. (Cont'd).* Région b-f du spectre solaire. *Mem. Spettr. Ital.* 28 (1899) 131-132.
- Sperra, W. E.* Maxima and Minima of Variable Stars. *Astron. J.* 15 (1895) 109-110.
- . Observations of variable stars. *Astron. J.* 16 (1896) 51-53; 17 (1896) 54, 70, 101, 118-119.
- Spies, P.* Fluorescenzerregung durch Uranstrahlen. *Verhandl. d. phys. Ges. Berlin* 15 (1896) 101.
- Spitaler, R.* Arbeiten und Fortschritten in der Astrophotographie im Jahre 1896. *Jahrb. d. Photogr.* 11 (1897) 130-134; *Beibl.* (1897) 977.
- Spitta, E. J.* A compound wedge-photometer. *Proc. Roy. Soc.* 47 (1890) 15-18; *Beibl.* (1890) 506.
- Spoerer, G.* Beobachtungen der Sonnenflecken. *Astron. Nachr.* 125 (1890) 215-518; *Beibl.* (1891) 207.
- Spring, W.* Die Farbe, specifische Gewicht und Oberflächenspannung des Wasserstoffsuperoxyds. *Ztsch. anorg. Chem.* 8 (1895) 424-434.
- . Les modifications physiques que subissent certains sulfures sous l'influence de la température. *Bull. Acad. Belg.* (3) 3 (1895) 311-320.
- . Die Durchlässigkeit der farblosen Salze für das Licht. *Beibl.* (1896) 776; *Bull. Acad. Belg.* 31 (1896) 640-654.
- . La couleur et le spectre lumineux de quelques corps organiques. *Bull. Acad. Belgique* (3) 32 (1896) 43-51; *Arch. de Genève* (4) 2 (1896) 105-112.
- . Die Farbe der Alkohole im Vergleich mit der Farbe des Wassers. *Ztsch. anorg. Chem.* 12 (1896) 253-261; *Beibl.* (1896) 535.
- . Le spectre d'absorption de quelques corps organiques incolores et ses relations avec la structure moléculaire. *Bull. Acad. Belg.* (3) 34 (1897) 165-195; *Arch. de Genève* (4) 3 (1897) 437-464.
- . Sur l'origine de la couleur bleue du ciel. *Bull. Acad. Belg.* (3) 36 (1898) 504-519; *Arch. de Genève* 7 (1899) 225-240.
- . Sur l'unité d'origine du bleu de l'eau. *Bull. Acad. Belg.* (3) 37 (1899) 72-81.
- . Sur la diffusion de la lumière par les solutions. *Rec. des trav. chim. des Pays-Bas* 18 (1899) 233-247; *Bull. Acad. Belg.* (3) 37 (1899) 300-315; *Beibl.* (1899) 633.



- Spring, W.** (*Cont'd*). Remarques sur une note recente de M. Pernter concernant la couleur bleue du ciel. Bull. Acad. Belg. (3) 37 (1899) 441-446.
- Spurge, C.** Wirkung der Politur auf die Reflexion des Lichtes von einer Fläche des Islandischen Doppelspathes. Proc. Roy. Soc. 41 (1887) 242.
- Spurge, J. B.** Note on a new photometric method and a photometer for the same. Proc. Phys. Soc. Lond. 69 (1894) 72; Beibl. (1894) 172.
- Staats, G.** Ueber die photochromatische Eigenschaften des Chlorsilbers. Ber. chem. Ges. 20 (1887) 2322; Jahresb. (1887) 366.
- —. Eisenchlorid und Chlorsilber im Sonnenlicht. Ber. chem. Ges. 21 (1888) 2199.
- Staigmüller, H.** Bestimmung der Brechungsexponenten organischer Flüssigkeiten aus Molekularformel und specifischem Gewicht derselben. Stuttgart, 1896, 24 pp.; Beibl. (1897) 28.
- Stanley, W. F.** The Functions of the Retina. I, The Perception of Colour. Chem. News 67 (1893) 71-72; Proc. Phys. Soc. Jan. 27, 1893.
- — —. Notes on the Nebular Theory in relation to stellar, solar, planetary, cometary, and geological phenomena. London: Kegan Paul, 1895, 260 pp.; Astrophys. J. 4 (1896) 159-160.
- Stapfer, D.** Lampes à incandescence par le gaz. System Auer. Beibl. (1893) 445.
- Stark, J.** Untersuchungen über Russ. Ann. Phys. n. F. 62 (1897) 353-367.
- Starke, H.** Ein Refraktometer zur Bestimmung des Brechungsexponenten von Flüssigkeiten mit dem Mikroskop. Verh. deutsch. phys. Ges. 1 (1899) 117-122.
- Stas, J. S.** De la nature de la lumière solaire. Mem. Acad. Belg. 49 (1891) 47 pp.; Beibl. (1892) 152.
- — —. Chemical Researches and Spectroscopic Studies of Various Chemical Elements. Chem. News 72 (1895) 177-179, 188-190, 192-193, 203-205, 215, 226-227, 239-241, 248-250, 259-261, 274-277, 284-286, 301-304, 311-313; 73 (1896) 5, 15, 29, 39, 51, 66, 80, 113, 124, 135, 147, 159, 171, 183, 192, 204, 216, 224, 241, 249, 263 (concluded).
- Stefanini, A.** Ricerche sui raggi di Röntgen e sui raggi oscuri della luce solare. Nuov. Cim. (4) 3 (1896) 306-307; 4 (1896) 18-24.
- Steinheil, R.** Beobachtungen über Rotations- und Refraktionsdispersion. Gekönte Preisschrift, München 1889, 56 pp.; Beibl. (1891) 558.



- Steinheil, R. (Cont'd).* Farbenkorrektion und sphärische Aberration bei Fernrohrprojektiven. Ztsch. Instrum. 19 (1899) 177-183; Beibl. (1899) 770.
- Stenger, F.* Lichtemission glühender fester Körper. Ann. Phys. n. F. 32 (1887) 271-275.
- . Die Bedeutung der Absorptionsstreifen. Botan. Ztg (1887) No. 8; Beibl. (1887) 709.
- . Die Gesetzmässigkeiten im Absorptionsspectrum eines Körpers. Ann. Phys. n. F. 33 (1888) 577-586.
- Stevens, J. S.* An application of interference methods to a study of the changes produced in metals by magnetisation. Phys. Rev. 7 (1898) 19-26.
- Stevens, W. L.* The sensitive flame as a means of research. Phil. Mag. (5) 27 (1889) 435-439.
- Stewart, O. M.* The absorption of the extraordinary ray in uniaxial crystals. Phys. Rev. 4 (1897) 433-456; Beibl. (1898) 405.
- . Résumé of the experiments dealing with the properties of Becquerel Rays. Phys. Rev. 6 (1898) 239-251.
- Stober, F.* La détermination de l'indice de réfraction de prismes à grands angles réfracteurs. Bull. Acad. Belg. (3) 30 (1895) 520-539.
- Stock, A.* Die verschiedenfarbigen Lösungen des Iods. Sitzb. Soc. phys. med. Erlangen, 13. Feb. 1893; Beibl. (1893) 1059.
- Stoddard, J. T.* Improved Wave-Apparatus. Amer. J. Sci. (3) 39 (1890) 218-219.
- Stokes, G. G.* The best methods of recording the direct intensity of solar radiation. Rept. Brit. Assoc. (1889) 40-41; (1892) 158-165.
- . An optical proof of the existence of suspended matter in flames. Proc. Roy. Soc. Edinb. (1890-1891) 263-264; Chem. News 63 (1891) 167; Beibl. (1892) 434.
- . Interactions occurring in flames. Chem. News 65 (1890) 90.
- . The Nature of the Röntgen Rays. Cambridge Proc. 9 (1896) 215.
- Stone, E. J.* Effects of distance upon the spectra of physical clusters of stars. Mon. Not. 57 (1896) 9-10.
- Stoney, G. J.* The cause of double lines and of equidistant satellites in the spectra of gases. Dublin Trans. (2) 4 (1891) 563-608; Beibl. (1892) 531; Rept. Brit. Assoc. (1891) 574.

- Stoney, G. J. (Cont'd).* Observation of the rotation of the Sun with the spectroscope. Rept. Brit. Assoc. (1891) 573-574; Beibl. (1893) 931.
- . The Line Spectra of the Elements. Nature 46 (1892) 200, 222.
- . Recent spectroscopic determinations. Nature 46 (1892) 513; Beibl. (1893) 799.
- . The cause of double lines in spectra. Rept. Brit. Assoc. (1891) 574.
- . Analysis of the spectrum of sodium, including an inquiry into the true place of the lines that have been regarded as satellites. Proc. Roy. Soc. Dublin, n. s. 7 (1892) 201-218; Phil. Mag. (5) 33 (1892) 503-516; Beibl. (1893) 201.
- . On the appreciation of ultravisible quantities, and on a gauge to help us to appreciate them. Phil. Mag. (5) 34 (1892) 415-428.
- . On the cause of spurious double lines sometimes seen with spectroscopes, and of the slender appendages which accompany them. Rept. Brit. Assoc. (1894) 583-585; Beibl. (1895) 423.
- . On the limits of vision. Proc. Dublin Soc. 8 (1894-1895) 228-244.
- . On the Kinetic Theory of Gas, regarded as illustrating Nature. Phil. Mag. (5) 40 (1895) 362-383.
- . On motions competent to produce groups of lines which have been observed in actual spectra. Rept. Brit. Assoc. (1895) 610-612; Beibl. (1896) 691.
- . The Meaning of the Line Spectra. Chem. News 72 (1896) 225-226; Beibl. 20 (1896) 531.
- . Atmospheres upon planets and satellites. Trans. Roy. Soc. Dublin (2) 6 (1897) 305-328; Astrophys. J. 7 (1898) 25-55.
- . Discussion of a New Theorem in Wave Propagation. Phil. Mag. (5) 43 (1897) 273-281.
- . On a supposed proof of a Theorem in Wave-Motion. Phil. Mag. (5) 43 (1897) 368-374; 44 (1897) 98-102, 206-211; Beibl. (1897) 964.
- . Perturbations of the lines in the spectrum. Nature 59 (1899) 294-295; Beibl. (1899) 300.
- Stortenbeker, W.* Farbenänderungen der Lösung von Kobaltchlorid. Beibl. (1894) 758.
- Stössel, J.* Lichtemission des glühenden Platins. Beibl. (1889) 945.

- Stratonoff, W.* Bestimmung der Rotationsbewegung der Sonne aus Fackelpositionen. *Astron. Nachr.* 137 (1895) 165-168; Beibl. (1895) 428.
- — Sur deux phénomènes de la physique solaire. *Mem. Spetr. Ital.* 25 (1896) 87-89.
- — Nouvelles substances dans les Pléiades. *Astron. Nachr.* 141 (1896) 103.
- — La nébuleuse annulaire de Lyra. *Astron. Nachr.* 142 (1896) 55-61.
- Straubel, R.* Die Berechnung der Fraunhofer'schen Beugungserscheinungen durch Raumintegrale mit besonderer Berücksichtigung der Theorie der Beugung im Heliometer. *Diss., Jena* 1888, 63 pp.; Beibl. (1890) 519.
- — Theorie der Beobachtungserscheinungen kreisförmig begrenzter, symmetrischer, nicht sphärischer Wellen. *Abhandl. d. bay. Akad.* (1893) 113-192; Beibl. (1894) 675.
- — Zwei allgemeine Sätze über Fraunhofer'sche Beugungserscheinungen. *Ann. Phys. n. F.* 56 (1895) 746-761.
- — Das Heliometerbild. *Astron. Nachr.* 139 (1896) 225-239; Beibl. (1897) 334.
- — Ueber einen Abbildungsfehler beim Prisma. *Ann. Phys. n. F.* 66 (1898) 346-349.
- — Ein Beleuchtungsapparat für monochromatisches Licht mit festen Spalten. *Ann. Phys. n. F.* 66 (1898) 350-352.
- Strehl, K.* Die Theorie des Fernrohrs auf Grund der Beugung des Lichts. I. Theil. *Leipzig: J. A. Barth.* 1894. 136 pp.
- — Ueber die Bestrebungen Michelson's zur Verbesserung des Heliometers. *Centralztg f. Opt. u. Mech.* 15 (1894) 145.
- — Optische Trugschlüsse. *Ztsch. f. Opt. u. Mech.* 16 (1895) 203.
- — Die Berechnung der Fernrohrobjective im Lichte der Beugungstheorie. *Sirius* 23 (1895) 159-163.
- — Beugungsbilder und deren Messung. *Ztsch. f. Instrum.* 16 (1896) 257-267; Beibl. (1897) 419.
- — Ueber den Einfluss der chromatischen Korrektur auf die Lichtstärke und Definition der Bilder. *Ztsch. f. Instrum.* 17 (1897) 50-54; Beibl. (1898) 836.
- — Die Lichtstärke der Beugungsbilder in absolutem Maass. *Ztsch. f. Instrum.* 17 (1897) 165-171; Beibl. (1898) 101.
- — Berechnung der Beugungsbilder. *Progr. d. Erlanger Gymnas.* 1898, 32 pp.

- Stscheglaieff, J.* Sur la dispersion anormale de la lumière dans les solutions de fuchsine. *J. de phys.* (3) 4 (1895) 546-551; Beibl. (1896) 272.
- —. Ueber die anormale Lichtdispersion in Fuchsinlösungen. *J. russ. phys. Ges.* 28 (1896) 41-55; Beibl. (1897) 409.
- —. Das Brechungsvermögen des mit Flüssigkeiten getrankten. Hydrophans. *Ann. Phys. n. F.* 64 (1898) 325-332; 65 (1898) 745.
- Stumpe, O.* Beiträge zur Bestimmung des Sonnen Apex. *Naturwiss. Rundsch.* 11 (1896) 441-443, *Astron. Nachr.* 140 (1896) 177-191.
- Sumner, W. E.* The Diffusion of Light. *J. Phys. Soc.*, Dec. 16, 1892; *Chem. News* 66 (1892) 300-302; Beibl. (1893) 821.
- Sundell, A. F.* Spectra of Air, Oxygen, Hydrogen, and Nitrogen. *Phil. Mag.* (5) 24 (1887) 98.
- Sundvik, E. E.* Meddelande lömingsars refraction. *Oefvers. Finska Vet. Soc. Förh.* 39 (1897) 1-11.
- Sutherland, W.* Molecular Refraction. *Phil. Mag.* (5) 27 (1889) 141.
- Svejar, Vlad.* Das umgekehrte Natrium-Spectrum. *Böhm. math. phys. Ztschr.* 21 (1892) 238.
- Swartz, Fred.* Die Atomrefraction des Fluors. Beibl. (1898) 150.
- Swinton, A. A. C.* Luminosity of the rare earths when heated in vacuo by means of cathode rays. *Proc. Roy. Soc.* 65 (1899) 115-119.
- Switzer, J. A.* Eine zuverlässige Methode der Aufzeichnung der Kurven variabler Ströme. *Phys. Rev.* 7 (1898) 83-92; Beibl. (1899) 49.
- Surynge daww, R.* Différence de l'action de la lumière ultraviolette sur les potentiels explosifs statique et dynamique. *C - R* 122 (1896) 131-134.
- —. Sur l'abaissement des potentiels explosifs dynamiques par la lumière ultra-violette et l'interprétation de certaines expériences de M. Jaumann. *C - R* 122 (1896) 1052-1054.
- Sykora, J.* Osservazioni spettroscopiche solari fatte a Charkow durante il 1894. *Mem. Spettr. Ital.* 23 (1894) 201-207.
- —. Les protubérances solaires observées en 1895 à l'observatoire de Charkow. *Mem. Spettr. Ital.* 25 (1896) 10-12, 173-179; 27 (1898) 33-39.
- —. Les protubérances solaires observées en 1898 à l'observatoire de Youriew. *Mem. Spettr. Ital.* 28 (1899) 11-18.

## T

- Tacchini, P.* Macchie e facole solari osservate al R. Osservatorio Romano nel 3 trimestre del 1894. *Mem. Spettr. Ital.* October, 1894.
- . Osservazioni sulle Leonidi. *Atti Accad. Roma* 4 (1895) 182-183.
- . Imagini spettroscopiche del bordo solare osservate a Catania e a Roma, 1894. *Mem. Spettr. Ital.* 24 (1894); C.-R. 120 (1894) 143, 710; *Beibl.* (1896) 32; *Astrophys. J.* 1 (1895) 210, 224-226.
- . Sulla distribuzione in latitudine dei fenomeni solari osservate al R. Osserv. Romano, 1895. *Mem. Spettr. Ital.* 42 (1895) 85-95, 110-116, 137-145; C.-R. 121 (1895) 412-414; *Astrophys. J.* 2 (1896) 252, abs.
- . Osservazioni sul pianeta Venere fatte al R. Osserv. Romano, 1895. *Mem. Spettr. Ital.* 25 (1896) 93-99.
- . (For a more complete list of Prof. Tacchini's numerous papers please see *Mem. Spettr. Ital.*).
- Takizawa, K.* Optical Note. *J. Coll. Sci. Japan* 5 (1892) 193-196.
- Tammann, G.* Die Aenderung des Brechungskoefficienten bei der Neutralisation der Bildung und Verdünnung von Lösungen. *Ztsch. f. physikal. Chem.* 21 (1896) 537-544; *Beibl.* (1897) 969.
- Tattnall, R. R.* Ein neuer Beweis einer Grundgleichung des Spectrometers. *Astron. and Astrophys.* 11 (1892) 932-933; *Beibl.* (1893) 824.
- Tebbutt, J.* Observations of the variable star R. Carinae. *Mon. Not.* 56 (1896) 351-352.
- Teclu, N.* Zur Kennzeichnung der Flammen. *J. prakt. Chem.* 44 (1891) 246-255; 51 (1895) 145-160; 56 (1897) 178-180.
- . Intensitätsbestimmung der Strahlen. *J. prakt. Chem.* n. F. 47 (1893) 568-584; *Beibl.* (1893) 919.
- Terby, F.* Sur la structure des bandes équatoriales de Jupiter. *Bull. Acad. Belg.* (3) 18 (1889) 373-376, 592-597; 19 (1890) 396-398; *Beibl.* (1890) 282, 788, 982.
- . Ueber den Anblick des Planeten Saturn. *Astron. Nachr.* 121 (1889) 109-111, 173-174, 233-234, 305-306, 335-336, 367-368; *Beibl.* (1889) 1010.
- . Ueber den weissen Fleck auf dem Saturnring. *Astron. Nachr.* 122 (1889) 105-108; *Beibl.* (1890) 1177.
- . Observations de la planète Mars. *Bull. Soc. Belge d'Astron.* 2 (1897) 50-58.

- Fereschin, C.* Zur Frage über die Abhängigkeit der Strahlung von der Temperatur. *J. russ. phys. chem. Ges.* 29 (1897) 169-276; Beibl. (1898) 312.
- Thalén, R.* Sur les spectres de l'yttrium, de l'erbium, du didyme et du lanthane. *Bull. Soc. chim. Paris* (2) 22 (1874) 350; *Svenk. Akad. Handl.* 12 (1873); *Jahresb.* (1874) 152.
- Spectraluntersuchungen über Scandium. *Oefvers. Vet. Akad. Stockholm*, 1881, No. 6. Beibl. (1887) 249.
- Thiele, E.* Spectrophotometrische Untersuchung der verschiedenfarbigen Iodlösungen. *Ztsch. f. phys. Chem.* 16 (1895) 147-156; Beibl. (1895) 426.
- Thiele, T. N.* On the law of spectral series. *Astrophys. J.* 6 (1897) 65-76. Beibl. (1898) 34.
- Resolution into series of the third band of the carbon spectrum. *Astrophys. J.* 8 (1898) 1-27.
- Thierry, Maur. de.* Un nouvel appareil dit "hema-spectroscope comparatur." *C.-R.* 120 (1895) 775-777.
- Thomas, L., et Ch. Trépiéd.* Sur l'application des hautes températures à l'observation du spectre de l'hydrogène. *C.-R.* 109 (1889) 524-525; Beibl. (1890) 39.
- Thomé, J.* Notes on variable stars. *Astron. J.* 15 (1895) 196; 16 (1896) 106.
- Thompson, C. M.* Absorption spectra of components of Didymium. *Chem. News* 55 (1887) 277.
- Thompson, G. C., and Tanner, H. W. L.* Notes on meteors observed at Penarth, Glamorgan, November 14, 1896.
- Thompson, S. P.* On the use of fluor-spar in optical instruments. *Phil. Mag.* (5) 31 (1891) 120-123; Beibl. (1891) 512.
- Some Notes on Photometry. *Phil. Mag.* (5) 36 (1893) 120-128; Beibl. (1894) 557.
- On Hyperphosphorescence. *Phil. Mag.* (5) 41 (1896) 103-107.
- Cathode Rays and some analogous rays. *Proc. Roy. Soc.* 61 (1897) 481-483.
- Electric shadows and Luminescence. *Chem. News* 75 (1897) 103-106, 111-113, 122 and 134.
- A Hertz-Wave Model. *Nature* 56 (1897) 342-343.
- Fire-Fly Light. *Nature* 56 (1897) 126.
- On the discovery by Right of the absorption in a magnetic field. *Rept. Brit. Assoc.* (1898) 789-790.



- Thompson, S. P. (Cont'd).* Light, visible and invisible. London: Macmillan, 1898, 294 pp.; Deutsche Ausgabe, von O. Lummer, Halle a. S.: S. S. Knapp, 1898, 229 pp.
- Thomsen, J.* Die Farbe der Ionen als Funktion der Atomgewichte. Ztsch. anorgan. Chem. 10 (1895) 155; Beibl. (1895) 887.
- . Ueber Abtrennung von Helium aus seiner natürlichen Verbindung unter starker Licht und Wärmeentwicklung. Ztsch. phys. Chem. 25 (1898) 112–114; Beibl. (1898) 267.—See Ramsay and Travers, Proc. Roy. Soc. 62 (1898) 325.
- Thomson, J. J.* The Electrolysis of Gases. Proc. Roy. Soc. 58 (1895) 1; Astrophys. J. 2 (1895) 394; Nature 51 (1895) 330–333.
- . The Röntgen Rays. Nature 53 (1896) 391–392, 581–583.
- Thorpe, T. E.* The Glow of Phosphorus. Roy. Inst. Gr. Brit. March 14, 1890; Beibl. (1890) 622.
- Thumm, K.* Zur Biologie der fluorescirenden Bakterien. Karlsruhe; O. Nemnich, 1895, 89 pp.; Beibl. (1895) 786.
- Thwing, C. B.* Color Photography by Lippmann's Method. Amer. J. Sci. (3) 42 (1891) 388–390; Beibl. (1892) 364.
- Tischomirow, W. A.* Absorptionsspectra aetherischer Oele. Russ. Ztsch. Pharm. 27 (1888) 545, 561; Jahresb. (1888) 442.
- Tikhoff, G. A.* La dispersion dans les espaces célestes. Mem. Spettr. Ital. 27 (1898) 41.
- Tilden, W. A.* An attempt to determine the condition in which Helium and the associated gases exist in minerals. Proc. Roy. Soc. 59 (1896) 218–224.
- . On the gases enclosed in crystalline rocks and minerals. Proc. Roy. Soc. 60 (1897) 453–457.
- Timiriaseff, C.* Die Beziehung zwischen der Intensität der Sonnenstrahlung und der Kohlensäure-Zerlegung durch die Pflanzen. Naturwiss. Rundschau 4 (1889) 646–647.
- Tissandier, G.* Balance photométrique à base d'iodure d'azote. La Nature 18 (1890) 219; Beibl. (1890) 1094.
- Tisserand, F.* Sur l'étoile variable  $\beta$  de Persei (Algol). C.-R. 120 (1895) 125–130.
- . Les variations de lumière de l'étoile Algol. Bull. mens. Soc. astron. France 1 (1895) 73–77.
- . Les vitesses radiales des nébuleuses. Bull. astron. 12 (1895) 196–198.
- Todd, D. P.* Automatic photography of the Corona. Astrophys. J. 5 (1897) 318–324.



- Todd, D. P.* On a practical method of photographing the spectrum of the Corona in numerous distinct regions. *Astrophys. J.* 8 (1898) 253.
- Tolomei, G.* Indice di rifrazioni dei raggi elettrici nel alcool. *Riv. Sci. industr.* 25 (1893) 71-72.
- Tomlinson, H.* The spectrum of R. Andromedae. *Nature* 40 (1889) 656.
- Tomlinson, H. J., and K. Pearson.* Note on Continuous Beams. *Phil. Mag.* (5) 46 (1898) 306-312.
- Tommasi, D.* Phénomènes lumineux produits par l'action de certains sels ammoniacaux sur l'azotite de potassium en fusion. *C.-R.* 128 (1899) 1107.
- Townsend, J. S.* Observations of solar prominences. *Jour. B. A. A.* 5 (1895) 153, 468.
- Trabert, W.* Die Warmestrahlung der atmosphärischen Luft. *Meteorol. Ztschr.* 9 (1892) 41-46; *Beibl.* (1892) 425.
- Trapesonjanz, Ch.* Die Molecularrefraction stickstoffenthaltender Substanzen (Aldoxime und Ketoxime). *Ber. chem. Ges.* 26 (1893) 1428-1443; *Beibl.* (1894) 335.
- Traube, J.* Lichtbrechung und Dichte. *Ber. chem. Ges.* 29 (1896) 2731-2742.
- Die Atomrefractionen von Kohlenstoff, Wasserstoff, Sauerstoff und den Halogenen. *Ber. chem. Ges.* 30 (1897) 38-43; *Beibl.* (1897) 510.
- Die Atomrefraction des Stickstoffes. *Ber. chem. Ges.* 30 (1897) 43-47; *Beibl.* (1897) 510.
- Travers, M. W.* Some experiments on Helium. *Proc. Roy. Soc.* 60 (1897) 449-453; *Astrophys. J.* 5 (1897) 363, Abs.
- The origin of the gases evolved on heating mineral substances, meteorites, etc. *Chem. News* 78 (1898) 317-318.
- Troost, L., et L. Ouyard.* Sur la combinaison du magnésium avec l'argon et avec l'hélium. *C. R.* 121 (1895) 394-396.
- Sur l'origine de l'argon et de l'hélium dans les gaz dégagés par certaines eaux sulfureuses. *C.-R.* 121 (1895) 788-800.
- Observation à l'occasion de la Communication de M. H. Becquerel. *C.-R.* 122 (1896) 694. (Uranium, Invisible Rays.)
- Trotter, A. P.* Ein neues Photometer. *Proc. Phys. Soc. Lond.* 12 (1893) 354-360; *Phil. Mag.* (5) 36 (1893) 82-88; *Beibl.* (1894) 667.
- Trouvelot, E. L.* Nouvelle éruption solaire. *C.-R.* 105 (1887) 610-612; *Beibl.* (1888) 103.

*Trouvelot, E. L. (Cont'd).* Chûte d'une protubérance solaire dans l'ouverture d'une tache. C.-R. 113 (1891) 437-438.

— — —. Observations sur les planètes Vénus et Mercure. Bull. Soc. astron. France (3) 2 (1892) 87 pp.

*Trowbridge, C. C.* Phosphorescent substances at liquid-air temperature. Science 9 (1899) 245-249.

*Trowbridge, J., and C. C. Hutchins.* Oxygen in the Sun. Amer. J. Sci. (3) 34 (1887) 263-271, 302-310; Beibl. (1888) 352-355.

—, —. On the existence of Carbon in the Sun. Proc. Amer. Acad. 23 (1887) 10-13; Amer. J. Sci. (3) 34 (1887) 345-348; Beibl. (1888) 356.

— — and *W. C. Sabine.* Selective absorption of the metals for Ultra-Violet Light. Phil. Mag. (5) 26 (1888) 316; Jahresb. (1888) 443.

—, —. Wave-length of metallic spectra in the ultra-violet. Phil. Mag. (5) 26 (1888) 342-353; Beibl. (1889) 382; Chem. News 58 (1888) 237, 247,—See W. N. Hartley, *ibid.* 304.

—, —. On the Use of Steam in Spectrum Analysis. Phil. Mag. (5) 27 (1889) 139-140; Beibl. (1889) 678; Amer. J. Sci. (3) 37 (1889) 114-116.

— —. Change of Period of Electricity in Iron-Waves. Amer. J. Sci. (3) 48 (1894) 307-311.

— —. Carbon and Oxygen in the Sun. Amer. J. Sci. (4) 1 (1896) 329-333; Phil. Mag. (6) 14 (1896) 450-454.

— — and *T. W. Richards.* Spectra of Argon. Amer. J. Sci. (4) 3 (1897) 15-21; Phil. Mag. (5) 43 (1897) 77-83.

—, —. The Multiple Spectra of Gases. Phil. Mag. (6) 43 (1897) 135-139; Amer. J. Sci. (4) 3 (1897) 117-120.

— — and *J. E. Burbank.* Phosphorescence produced by electrification. Phil. Mag. (5) 45 (1898) 100-102; Amer. J. Sci. (4) 5 (1898) 55-57.

*Tscherning.* Les sept images de l'œil humain. Séances de la Soc. franç. de phys. (1892) 288-296.

*Tschirch, A.* Der Quarzspectrograph und einige damit vorgenommene Untersuchungen von Pflanzenfarbstoffen. Naturwiss. Rundsch. 11 (1896) 240-242; Beibl. (1896) 535.

— —. Untersuchungen reiner Blattfarbstoffe mit dem Quarzspectrographen. Photogr. Mittheil. (1896) Heft 24, 3 pp.; Beibl. (1897) 130.

*Tucker, R. H.* Charts of Faint Stars for Magnitude Comparison. Pub. Astron. Soc. Pac. 8 (1896) 95-98.

- Tuckerman, A.* Index to the Literature of the Spectroscope (1860-1887). Smithsonian Miscell. Coll. 658, 423 pp; Beibl (1889) 836. Amer. J. Sci. (3) 36 (1888) 303, 388.
- Tufts, F. L.* The New Flicker Photometry. Trans New York Acad. Sci. 16 (1897, 190-212; Beibl (1897) 971.
- Umhirc, O.* Einfacher Apparat zur Demonstration der Umkehrung der Natriumlinien. Repert d. Phys. 23 (1887) 404 405.
- — Das mechanische Aequivalent des Lichtes. Sitzb Wiener Akad. 98 (1889) 826-851. Ann Phys. n. F. 38 (1889) 640 663.
- — und A. Krug Die Energie der Wärmestrahlung bei der Weissgluth 13 Dec. 1888. Sitzb. Wiener Akad. 97 II (1889) 1529 1559; Beibl. (1889) 499.
- Turner, H. H.* On differential refraction in terms of higher order than the first Mon Not 57 (1897) 133 140.
- Tutton, A. E.* An instrument of precision for producing monochromatic light any desired wave-length. Phil. Trans. 185 (1895) 913 943.
- — A new element in the Nitrogen Group. Nature 51 (1895) 258.
- — A Compensating Interference Dilatometer. Proc Roy. Soc 63 (1898) 208 211; Beibl. (1899) 342, 422, Ztsch Kryst. u Min. 31 (1899) 383 384.

## U

- Udransky, L. von.* Absorptionsspectra von Furfurolverbindungen. Ztsch physiol Chem. 12 (1888) 355, 13 (1888) 248; Jahresh. (1888) 1524-1532.
- Uhthoff, W.* Die zur Erzeugung eben merklicher Farbendifferenzen erforderlichen Aenderungen der Wellenlänge spectralen Lichtes. Archiv f Physiol (1889) 171 172; Beibl. (1889) 690.
- — Die Abhängigkeit der Sehscharfe von der Lichtintensität bei spectraler Beleuchtung. Verh. d phys Ges Berlin 8 (1889) 9-12; Beibl. (1891) 284.
- — Die kleinsten wahrnehmbaren Gesichtswinkel in den verschiedenen Theilen des Spectrums. Ztsch. f. Psychol. u. Physiol. d Sinnesorgane 1 (1890) 155-160.
- Uppenborn, F.* Constante Vergleichslichtquellen für photometrische Zwecke. Ber. electrotechn. Versuchsstation München (1888) 12 pp; Beibl (1888) 525.
- — Die Schwächung des Lichtes in einem Photometerspiegel. Ber. electrotechn. Versuchsstation München (1890) No. 14; Beibl. (1890) 778.

## V

- Valenta, E.* Die Photographie in natürlichen Farben, mit besonderer Berücksichtigung des Lippmann'schen Verfahrens. Halle a. S. 1894, 82 pp.; Verh. deutsch. Naturf. u. Aerzte II 1 (1895) 78-79.  
 ——. See *Eder, u. V.*
- Varley, F. H.* A new direct reading photometer measuring from Unity to Infinity. Rept. Brit. Assoc. (1890) 759-760.
- Verdet.* See *(Œuvres IV, 2<sup>e</sup> partie, 815, Bibliographie de la lumière diffusée; and A. Crova, Ann. Chim. phys. (6) 20 (1890) 480-504.*
- Vernueil, A.* Sur la préparation du sulfure de calcium à phosphorescence violette. C.-R. 103 (1886) 600; Bull. Soc. chim. (2) 46 (1886) 302; Jahresb. (1886) 395.  
 ——. Les causes déterminantes de la phosphorescence du sulfure de calcium. C.-R. 104 (1887) 501-504, Beibl. (1887) 438.  
 ——. Recherches sur la blende hexagonale phosphorescente. C. R. 106 (1888) 101-104; 106 (1888) 1104-1107; Beibl. (1888) 476; (1889) 19.
- Verhaffelt, J.* Application du refractomètre à l'étude des réactions chimiques. Indices de réfraction de mélanges d'eau, d'alcools et d'acide gras. Bull. Acad. roy. Belg. (3) 27 (1894) 69-84; 28 (1894) 49-84, Beibl. (1894) 833.
- Verwer, H.* Studien über Aluminate und Pikrate. Diss. Erlangen, 1896, 45 pp.; Beibl. (1897) 228.
- Very, F. W.* Photometry of a lunar eclipse. Astrophys. J. 2 (1895) 293-305, Beibl. (1896) 699.  
 ——. Note on earlier observations of atmospheric absorption bands in the infra-red spectrum. Astrophys. J. 2 (1895) 237.  
 ——. On the probable temperature of the Moon. Astrophys. J. 8 (1898) 199-217, Beibl. (1899) 179.  
 ——. Note on the position of the maximum of the spectral-energy curve of a black body. Astrophys. J. 10 (1899) 208.
- Vicaire, E.* Das Rotationsgesetz der Sonne. Bull. Soc. philom. 2 (1889-1890) 159-170; Beibl. (1891) 34.
- Vicentini, G.* Fenomeni luminosi prodotti dal conduttori percorsi dalle scariche elettriche e posti nel aria rarefatte. Rend. Accad. Roma (5) 1 (1892) 13-17, 143-149, 235-241.
- Villard, P.* Sur les effets de mirage et les différences de densités qu'on observe dans les tubes de Natterer. Seances Soc. franç. de Phys. (1896) 73-82.  
 ——. Étude des gaz liquifiés. Ann. chim. phys. (7) 10 (1897) 387-432.

- Villard, P.* L'expérience de la croix de Crookes; la régénération des écrans au platinocyanure de baryum par la lumière. *Éclairage élect.* 16 (1898) 313-314.
- Villari, E.* Osservazioni intorno ad alcuni fenomeni di fosforescenza e fluorescenza. *Nuov. Cim.* (3) 29 (1891) 36-42; *Beibl.* (1891) 517.
- — Sulle cariche e figure elettriche alla superficie dei tubi del Crookes e del Geissler. *Nuov. Cim.* (4) 3 (1896) 359-364.
- — Dell'azione dell'ozonatore sulla proprietà scaricatrice destata nei gas dalle scintille e dalle fiamme. *Nuov. Cim.* 5 (1897) 459-466.
- — Dell'azione dei tubi opachi sui raggi X. *Nuov. Cim.* 7 (1898) 270-272.
- Villiger, W.* Notiz betreffend den dunklen Fleck auf Jupiter. *Astron. Nach.* 140 (1896) 319.
- — Bemerkung bez. B. D. + 23°699 und - 2°5842. *Astron. Nachr.* 142 (1897) 337.
- Villon.* Beleuchtung mit Aluminium. *Photogr. Mittheil.* 29 (1892) 209-212.
- Viola* Metodo per determinare l'indice di rifrazione della luce di un minerale nelle lamine sottili. *Atti Accad. Roma* (1896) 212.
- Violle, J.* Comparaison des énergies rayonnées par le platine et l'argent fondants. *C.-R.* 105 (1887) 163-165; *Beibl.* (1887) 702.
- — Sur le rayonnement des corps incandescents et la mesure des hautes températures. *C.-R.* 114 (1892) 734-737.
- — Rayonnement de différent corps réfractaires chauffés dans le four électrique. *C.-R.* 117 (1893) 33-34.
- — Sur la température de l'arc électrique. *C.-R.* 119 (1894) 949-951.
- — Un étalon photométrique à l'acétylène. *Seance Soc. franç. de Phys.* (1896) 39-40, 165; *Beibl.* (1896) 275.
- Vogel, E.* Herstellung farbiger Gläser für Dunkelkammerlanternen. *Photogr. Mittheil.* 26 (1890) 135-136.
- — Ueber blau- und violetteneempfindliches Bromsilber. *Photogr. Mittheil.* 28 (1891) 139-140; *Beibl.* (1892) 281.
- — Ueber Lichtempfindlichkeit der Eosinfarbstoffe. *Photogr. Mittheil.* 28 (1891) 140-141.
- Vogel, H. C.* Ueber Sternspectra. *Vierteljahrssachr. d. astron. Ges.* 22 (1887) 57-59.
- — Mittheilungen zur Herstellung der photographischen Himmelskarte. *Astron. Nachr.* (1888) 1-6; *Beibl.* (1889) 81.

- Vogel, H. C. (*Cont d.*). Ueber die Bestimmung der Bewegung von Sternen im Visionsradius durch spectrographische Beobachtungen Sitzb. Berliner Akad. (1888) 397-401, Astron. Nachr. (1888) 97-100; (1889) 241-258; Beibl. (1889) 947-949.
- Spectrographische Beobachtungen an Algol. Astron. Nachr. 123 (1889) 289-292, Beibl. (1890) 289-292, 789.
- ——. Bewegungserscheinungen an  $\alpha$  Virginis. Sitzb. Wiener Akad. 22 (1890) 401-402, Beibl. (1890) 622.
- ——. Das Eisenspectrum als Vergleichsspectrum bei spectrographischen Aufnahmen zur Bestimmung der Bewegung der Sterne im Visionsradius Sitzb. Berliner Akad. 28 (1891) 533-539; Beibl. (1892) 155.
- ——. Die Bahnbewegung von  $\alpha$  Virginis. Astron. Nachr. 125 (1891) 305-316, Beibl. (1891) 108.
- ——. Beobachtungen der auf spectrographischen Wege aufgefundenen binaren Systeme  $\beta$  Aurigae und  $\varphi$  Ursae Majoris auf dem Potsdamer Observatorium. Astron. Nachr. 126 (1891) 265-272.
- ——. Eigenbewegung der Sterne im Visionsradius auf spectrographischen Wege. Pub. astrophys. Observ. Potsdam 7 (1892) 166 pp.; Beibl. (1893) 128.
- ——. Neue Bezeichnung für die Wasserstofflinien. Astron. Nachr. 134 (1894) 95-96.
- ——. Ueber den neuen Stern im Fuhrmann. Abhandl. d. Berliner Akad. (1893) 157-217; Beibl. (1893) 932.
- ——. The Spectrum of  $\beta$  Lyrae. Astron. and Astrophys. 13 (1894) 561-568.
- ——. Bemerkungen zu der Abhandlung des Hrn. Prof. H. Kayser: "Ueber den Einfluss der Spaltweite auf das Aussehen der Kometenspectra." Astron. Nachr. 135 (1894) 105-108; Beibl. (1894) 766.
- ——. Recent researches on the spectra of the planets. Astrophys. J. 1 (1895) 196-209, 273-284 (comm. by Author from Sitzb. Berliner Akad. (1895) 5-25); Beibl. (1895) 429.
- ——. Ueber das Vorkommen der Linien des Cleveitgasspectrums in den Sternspectren, und über die Klassifikation der Sterne vom ersten Spektraltypus. Sitzb. Berliner Akad. (1895) 947-958; Astrophys. J. 2 (1895) 333-346.
- ——. Das Spektrum von Mira Ceti. Sitzb. Berliner Akad. (1896) 395-399; Astrophys. J. 4 (1896) 158; Beibl. (1897) 345.



- Vogel, H. C.* Die Lichtabsorption als maassgebender Faktor bei der Wahl der Dimensionen des Objectivs für den grossen Refraktor des Potsdamer Observatorium. Sitzb. Berliner Akad. (1896) 1219-1231; Beibl. (1897) 512.
- . Sources of error in investigations on the motion of stars in the line of sight. *Astrophys. J.* 7 (1898) 249-254.
- . Einige Bemerkungen über den Kirchhoff'schen Spektralapparat. Sitzb. Berliner Akad. (1898) 141-147, Beibl. (1898) 312.
- . Das Spektrum von  $\alpha$  Aquilae und über die Bewegung des Sterns im Visionsradius. Sitzb. Berliner Akad. (1898) 721-734; Beibl. (1899) 181; *Astrophys. J.* 9 (1899) 1-14.
- . Das Spektrum von  $\alpha$  Aquilae und die Bewegung des Sterns im Visionsradius. Sitzb. Berliner Akad. (1898) 721-734; Beibl. (1899) 181; *Astrophys. J.* 9 (1899) 1-14.
- und  $\gamma$  Wilsing. Die Spektra von 528 Sternen. Pub. Observ. Potsdam 12 (1899) 73; Beibl. (1899) 361.
- Vogel, H. W.* Anilinblau, Chrysanilin, Methylviolett. *Ann. Phys.* n. F. 28 (1886) 130; Jahresb. (1886) 305.
- . Photochemische Methode zur Messung der chemischen Wirkung des Sonnenlichtes. *Chem. Centralbl.* (1886) 785; Jahresb. (1886) 316.
- . Neue Fortschritte in dem farbenempfindlichen Verfahren. Methode Photographien des Spektrums zu erhalten. Sitzb. preuss. Akad. 51 (1886) 1201-1208.
- . Beziehungen zwischen Zusammensetzung und Absorptionsspectren organischer Farbstoffe. Sitzb. Berliner Akad. (1887) 715-718.
- . Farbenwahrnehmungen. *Naturwiss. Rundsch* 3 (1888) 185-186, 220.
- . Die Spektra des Cyans und des Kohlenstoffs. Sitzb. Berliner Akad. 21 (1888); *Verh. d. phys. Ges. Berlin* 15 (1888) 523-528.
- . Spektroskopische Weinprüfung. *Ber. chem. Ges.* 21 (1888) 1746.
- . Hilfsmittel für spektroskopische Arbeiten. *Ber. chem. Ges.* 21 (1888) 2029; Jahresb. (1888) 434; Beibl. (1888) 736.
- . Praktische Spektralanalyse irdischer Stoffe. 2e Auflage. Berlin: R. Oppenheim, 1889, 515 pp. I. Aufl. 1877.
- . Farbenwahrnehmungen. *Verh. d. phys. Ges. Berlin* (1890) 1-8; Beibl. (1890) 629.



- Vogel, H. V.* (Cont'd) Lippmann's Photographien des Spektrum's in natürlichen Farben. Verhandl. d. physikal. Ges. Berlin 10 (1891) 33-35; Beibl. (1891) 560.
- — — Die Photometrie farbiger Strahlen, und über Messung der chemischen Intensität des Tageslichtes und des verschiedenfarbigen Lichtes. Verh. d. phys. Ges. Berlin 10 (1891) 35-46; Beibl. (1891) 560.
- — — Beobachtungen über die Farbenhelligkeit der Atmosphäre. Photogr. Mittheil. 29 (1892) 73-75, 138-141, 156-159, 172-175; Beibl. (1892) 740.
- — — Das neue Auer'sche Gasglühlicht. Photogr. Mittheil. 29 (1892) 302-304, 383-385; Beibl. (1893) 748, 925.
- — — Ueber Gasglühlicht. Photogr. Mittheil. 31 (1895) 314-315, 367-369; Beibl. (1895) 242-222.
- — — Die farbigen Wässer der Caprener Grotten, der Schweizer Eishöhlen und Yellowstonequellen. Ann. Phys. n. F. 54 (1895) 175-177.
- — — Farbenwahrnehmungen. Ann. Phys. n. F. 54 (1895) 668-674, 745-751.
- — — Das sogenannte künstliche Spektrum. Verh. d. phys. Ges. Berlin 14 (1896) 45-47.
- — — Das Magnesiumsensitometer. Jahrb. f. Photogr. 10 (1896) 230-236.
- — — Beobachtungen an farbigen Interferenzphotographien. Verh. d. phys. Ges. Berlin 16 (1897) 176-178.
- — — Bunsen-Roscoe's Untersuchungen über das photographische Wetter. Jahrb. f. Photogr. 11 (1897) 217-220; Beibl. (1897) 982.
- — — Ueber Farbenwahrnehmungen. Verh. deutsch. Naturf. u. Aerzte 2 I (1898) 44-47.
- Vogel, O.* Die Anwendung der Leuchtgassauerstofflampe zu spektralanalytischen Mineraluntersuchungen. Ztsch. anorg. Chem. 5 (1893) 42-62; Beibl. (1894) 84.
- Voigt, W.* Zur Theorie des Lichtes für absorbirende isotrope Medien. Ann. Phys. n. F. 31 (1887) 233-243.
- — — Ueber die Reflexion und Brechung des Lichtes an Schichten absorbirender isotroper Medien. Ann. Phys. n. F. 35 (1888) 76-100.
- — — Theorie des Lichtes für bewegte Medien. Ann. Phys. n. F. 35 (1888) 370-397, 524-552.
- — — Fluorescenz und kinetische Theorie. Götting. Nachr. (1896) 184-185.

- Voigt, W.* Die Aenderung der Schwingungsform des Lichts beim Fortschreiten in einem dispergirenden oder absorbirenden Mittel. Götting. Nachr. (1896) 186-190; Beibl. (1896) 331.
- . Die Lage der Absorptionsbuschel in zweiaxigen pleochroistischen Krystallen. Götting. Nachr. (1896) 252-254, 560-562; Beibl. (1897) 1.
- . Doppelbrechung von im Magnetfelde befindlichen Natriumdampf in der Richtung normal zu den Kraftlinien. Götting. Nachr. (1898) 6 pp.
- . Zusammenhang zwischen dem Zeemann'schen und dem Faraday'schen Phänomen. Götting. Nachr. (1898) 16 pp.; Verh. deutsch. Naturf. u. Aerzte II 1 (1899) 43-47.
- . Die Proportionalität von Emissions- und Absorptionsvermögen. Ann. Phys. n. F. 67 (1899) 366-387.
- . Weiteres zur Theorie des Zeemann Effekts. Ann. Phys. n. F. 68 (1899) 352-364.
- . Die Aenderung der Schwingungsform des Lichtes beim Fortschreiten in einem dispergirenden oder absorbirenden Mittel. Ann. Phys. n. F. 68 (1899) 508-603.
- . Die Erklärung der unter gewissen Umständen eintretenden Verbreiterung und Umkehrung der Spektrallinien. Ann. Phys. n. F. 68 (1899) 604-606.
- . Bemerkung über die bei Zeemann'schen Phänomenen stattfindenden Intensitätsverhältnisse. Ann. Phys. n. F. 69 (1899) 290-296.
- . Zur Theorie der Einwirkung eines elektrostatischen Feldes auf die optischen Eigenschaften der Körper. Ann. Phys. n. F. 69 (1899) 297-318.
- Volkman, P.* Vorlesungen über die Theorie des Lichtes. Leipzig, 1891, 432 pp.

## W

- Wadsworth, F. L. O.* New design for large spectroscope slits. Amer. J. Sci. (3) 48 (1894) 19-21; Beibl. (1894) 99.
- . Improved Form of Littrow Spectroscope. Phil. Mag. (5) 37 (1894) 137-143; Beibl. (1895) 59.
- . Fixed-Arm Spectroscopes. Phil. Mag. (5) 38 (1894) 337-351; Beibl. (1895) 782; Astron. and Astrophys. 13 (1894) 835-849.
- . General considerations respecting the design of astronomical spectroscopes. Astrophys. J. (1895) 52-79.

- Wadsworth, F. L. O. (Cont'd)* Fixed Arm Concave-Grating Spectroscopes. *Astrophys. J.* 2 (1895) 370-382.
- — — The conditions of maximum efficiency in the use of the spectrograph. *Astrophys. J.* (1896) 321-347.
- — — The use and mounting of the concave grating as an analyzing or direct comparison spectroscope. *Astrophys. J.* 3 (1896) 47-62.
- — — Simple device for isolating any portion of the diffraction spectrum, and some notes on astronomical spectroscopes. *Astrophys. J.* 3 (1896) 169-191.
- — — New form of fluid prism without solid walls. *Astrophys. J.* 4 (1896) 274-277.
- — — Note on the preparation of phosphorescent barium sulfide. *Astrophys. J.* 4 (1896) 308.
- — — The Application of the Interferometer to the measurement of small angles of refraction. *Phys. Rev.* 4 (1897) 480-497; *Beibl.* (1898) 623.
- — — Thermal measurements with the bolometer by the zero method. *Astrophys. J.* 5 (1897) 268-276.
- — — Tables of the practical resolving power of spectroscopes. *Astrophys. J.* 6 (1897) 27-36.
- — — The conditions of maximum efficiency in astrophotographic work. *Astrophys. J.* 6 (1897) 119-135.
- — — Note on the effect of heat on phosphorescence. *Astrophys. J.* 6 (1897) 153-155.
- — — The resolving power of telescopes and spectroscopes for lines of finite width. *Phil. Mag.* (5) 43 (1897) 317-343; *J. de phys.* 6 (1897) 409-425, *Mem. Spettr. Ital.* 26 (1897) 2-24; *Ann. Phys. n. F.* 61 (1897) 604-630.
- — — Note on the discovery of an error in the papers of Struve and Lord Rayleigh. *Astrophys. J.* 7 (1898) 77-85.
- — — Notes on the use of the Grating in stellar spectroscopic work. *Astrophys. J.* 7 (1898) 198-207.
- Wagner, F.* Die Farbe der Ionen. *Ztsch. phys. Chem.* 12 (1893) 314-321.
- Walden, P.* Diffusionserscheinungen an Niederschlagsmembranen. *Ztsch. f. phys. Chem.* 10 (1892) 699-732.
- Walker, F.* The admissible width of the slit in interference experiments. *Phil. Mag.* (5) 46 (1898) 472-478.
- — The orientation of the slit in interference experiments. *Phil. Mag.* (5) 46 (1898) 553-557. *Beibl.* (1899) 183.

- Wallach, O.* Das Absorptionsvermögen gewisser ungesättigter Ketone für die violetten Lichtstrahlen. *Gött. Nachr.* (1896) 9 pp.; *Beibl.* (1897) 633.
- — — Refraktions- und Dispersionsvermögen einer Reihe isomerer Kampfer. *Gött. Nachr.* (1896) 63-73; *Beibl.* (1897) 732.
- Waller, E.* Argon. *School of Mines Quar.* (3) 16 (1895) 220-226.
- Wallerant, Fr.* Messung der Doppelbrechung der Mineralien in dünnen Schichten. *Beibl.* (1898) 156.
- — — Perfectionnement du réfractomètre pour les cristaux microscopiques. *Bull. Soc. min. Paris* 22 (1899) 69-71.
- Walter, A.* Theorie der atmosphärischen Strahlenbrechung. Leipzig: Teubner 1898. 74 pp.
- Walter, B.* Aenderung des Fluorescenzvermögens mit der Concentration. *Ann. Phys. n. F.* 34 (1888) 316-326, 36 (1889) 502-518.
- — — Nachweis des Zerfalles von Molekulargruppen in Lösungen durch Fluorescenz- und Absorptionserscheinungen. *Ann. Phys. n. F.* 36 (1889) 518-532, 45 (1892) 189.
- — — Die Brechungsexponenten von Salzlosungen. *Ann. Phys. n. F.* 38 (1889) 107-118; *C.-R.* 110 (1890) 708-709.—see Doumer, p. 957.
- — — Eine charakteristische Absorptionserscheinung des Diamanten. *Jahresb. d. Hamburger wiss. Anstalt* 8 (1891) 5 pp.
- — — Die Brechbarkeit und die Wellenlänge der Röntgen Strahlen. *Naturwiss. Rundsch.* 11 (1896) 322-323.
- — — Die Brechungsexponenten des festen Fuchsin. *Ann. Phys. n. F.* 57 (1896) 394-396; *Astrophys. J.* 5 (1897) 68.
- Wanack, B.* Theorie des Reversionsprismas. *Ztsch. f. Instrum.* 19 (1899) 161-177.
- Wanner, H.* Notiz über die Verbreiterung der D-Linien. *Ann. Phys. n. F.* 68 (1899) 143-144.
- Warburg, E.* Die Wärmeleitung und Temperatur der in Geissler'schen Röhren leuchtenden Gasen. *Ann. Phys. n. F.* 54 (1895) 265-275.
- Warren, H. N.* Improved form of induction coil for spectroscopic work. *Chem. News* 65 (1892) 87-88.
- Wasastjerna, L.* Das Brechungsvermögen des Quarzes für verschiedene Farben des Spectrums mit einer neuen Formel, um deren Werthe zu berechnen. *Finska Vet. Forh.* (1888) 167-177; *Beibl.* (1891) 111.
- Waterman, Dr. Sigismund.* 1819-1899 [He introduced the study of spectroscopic analysis into the practice of medicine in the United States]. *Trans. New York Acad. Med.* (2) 1 (1871-1873)

- 61 100, *Med. Rev. New York* 9 (1874) 529-536; *Med. Gaz. N. Y.* 2 (1868) 331-347; *Do.* 4 (1870) 269-274.
- Watts, W. *Manual. Index of Spectra.* 2d edition, revised and enlarged. Manchester 1889, 232 pp. continued in appendices to 1900 inclusive.
- — — Wave-length tables of the spectra of elements and compounds. Rept. Brit. Assoc. [This has been issued in parts from 1884-1900 both inclusive in the Reports of the British Association.]
- Waukh, W. R. *Stellar Chromatics.* *Observ.* 18 (1895) 234.
- Wave Length Tables of the Spectra of the Elements. Reports of the Committee of the British Association from 1884 to 1900 both inclusive.
- Weber, H. F. Die Entwicklung der Lichtemission glühender fester Körper. *Ann. Phys. n. F.* 32 (1887) 256-271, 491-504. See Stenger, same vol. 271-275.
- — — Untersuchungen über die Strahlung fester Körper. *Sitzb. Berliner Akad.* (1888) 565-589, 933-957; *Beibl.* (1890) 897-900, (1893) 920.
- Weber, H. S. A general theory of the Glow-Lamp. *Phys. Rev.* 2 (1895) 112, 197.
- Weber, L. Zur Theorie des Bunsen'schen Photometers. *Centralztng. f. Optik u. Mechanik* 8 (1887) 5-7; 9 (1888) 14-18; *Ann. Phys. n. F.* 31 (1887) 676.
- — — Zur Frage der photometrischen Einheiten. *Beibl.* (1897) 411.
- Wehner, F. H. Die Reflexion und Brechung des Lichtes an der Grenze unkrystallinischer Medien. *Grunert's Archiv* (2) 9 (1890) 337-374; *Beibl.* (1891) 210.
- Weigle, A. Beiträge zur quantitativen Spectralanalyse. *Diss. Tübingen*, 1890, 67 pp.
- — — Spectrophotometrische Untersuchungen der Salze aromatischer Basen. *Ztsch. phys. Chem.* 11 (1893) 227-247.—See L. Meyer, p. 426.
- Weinschenk, E. Vergleichende Studien über die dilute Färbung von Mineralien. *Ztsch. f. anorg. Chem.* 12 (1896) 375-393; *Beibl.* (1896) 777; 21 (1896) 515.
- Weiss, E. Veränderlicher Stern Z Virginis. *Astron. Nachr.* 140 (1896) 343.
- Weiss, G. Mesure des indices de réfraction. *J. de phys.* 6 (1897) 688-690; *Beibl.* (1898) 557.

- Weiss, P.* Sur l'emploi des franges de diffraction à la lecture des déviations galvanophotométriques. C-R. 128 (1899) 876-877.
- Wellmann, V.* Zur Photometrie der Jupiter-Trabanten. Diss. Berlin, 1887, 46 pp.; Beibl. (1887) 705.
- —. Einfluss der Temperatur auf die Messungen mit doppelbrechenden Prismen. Beobachtungsergebn. Potsdam (1892) 75-79.
- Wendt, G.* Eine Theorie des Polarlichts. Naturwiss. Wochenschr. 12 (1897) 469-477.
- Wernicke, W.* Normale und anomale Phasenänderung bei der Reflexion des Lichtes an Metallen. Ann. Phys. n. F. 51 (1894) 448; 52 (1894) 515.
- Wesendonck, K.* Einige Versuche über die entladenden Wirkungen der Flammengase. Naturwiss. Rundsch. 12 (1897) 288-290.
- West, R. H.* New Variables. Astron. J. 16 (1896) 23, 85, 211; 17 (1896) 3, 54, 88.
- Whitman, F. P.* The photometry of differently colored lights and the "Flicker" photometer. Proc. Amer. Assoc. (1895) 56; Phys. Rev. 3 (1895-1896) 241-249.
- Widmark, J.* Die Durchlässigkeit der Augenmedien für ultraviolette Strahlen. Archiv. f. Physiol. 3 (1891) 463-502.
- —. Die Grenze des sichtbaren Spektrums. Akad. Stockholm Forh. 54 (1897) 287-307; Beibl. (1898) 573.
- Wiedeburg, O.* Zur Theorie der Diffusion und Electrolyse. Ztsch. phys. Chem. 9 (1892) 143-152; 10 (1892) 509-516.
- —. Der Interferentialrefractor für elektrische Wellen. Ann. Phys. n. F. 59 (1896) 497-522.
- Wiedemann, E.* Fluorescenz und Phosphorescenz. Ann. Phys. n. F. 34 (1888) 446-463, 463-469; Jahresb. (1888) 445.
- — und *H. Ebert.* Elektrische Entladungen in Gasen und Flammen. Ann. Phys. n. F. 35 (1888) 209-264; 36 (1889) 643-655.
- —. Die Mechanik des Leuchtens. Ann. Phys. n. F. 37 (1889) 177-249; Phil. Mag. (5) 28 (1889) 149, 248, 376; Jahresb. (1889) 321.
- —. Kathodo- und Protoluminescenz von Gläsern. Ann. Phys. n. F. 38 (1889) 488.
- — und *G. C. Schmidt.* Lichtemission organischer Substanzen im gasförmigen, flüssigen und festen Zustand. Ann. Phys. n. F. 56 (1895) 18-26.
- —. Luminescenz von reinen anorganischen Körpern und von festen Lösungen. Ztsch. phys. Chem. 18 (1895) 529-553.



- Wiedemann, E. und G. C. Schmidt (*Cont d*) Spektralbeobachtungen an verdünnten Dämpfen von Metallen und Verbindungen. *Naturwiss. Rundsch.* 11 (1896) 420-432. Beibl. 1896, 693.
- , —. Fluorescenz und Verbindungsspektren organischer Dämpfe. *Jahrb. f. Photogr. u. Reprod.* (1896) 14-15.
- , —. Photochemische Zersetzung von NaCl, KCl, NaBr und KBr unter dem Einfluss von stark brechbarem ultravioletten Lichte. *Jahrb. f. Photogr. u. Reprod.* (1896) 15.
- , —. Fluorescenz des Natrium- und Kaliumdampfes und Bedeutung dieser Thatsache für die Astrophysik. *Ann. Phys. n. F.* 57 (1896) 447-453; *Sitzb. phys. med. Soc. Erlangen* Nov. 12, 1895; *Astrophys. J.* 3 (1896) 207-212. — See *Ann. Phys. n. F.* 56 (1895) 18; and Lommel *Ann. Phys. n. F.* 19 (1883) 850.
- , —. Ueber sogenannte Interferenzflächen an der Kathode und die electrostatische Abstossung der Kathodenstrahlen. *Ann. Phys. n. F.* 60 (1896) 510-518.
- , —. Die Schwere in der Grube Sala. *Sirius* 24 (1896) 60-67.
- , —. Das Fluorescenzspektrum des Natriums. *Verh. d. phys. Ges. Berlin* 16 (1897) 37-40; Beibl. (1897) 417.
- , —. Luminescenz und astrophysikalische Probleme. *Vierteljahrsh. d. astron. Ges.* 31 (1897) 250, 258, 261.
- , —. Spektralerscheinungen. *Verh. deutsch. Naturf. u. Aerzte* II 1 (1897) 66.
- Wien, W. Beugung des Lichts und Absorptionserscheinungen. *Ann. Phys. n. F.* 28 (1886) 117.
- , —. Durchsichtigkeit dünner Metallschichten. *Ann. Phys. n. F.* 35 (1888) 48-62.
- , —. Aenderung der Energievertheilung im Spectrum eines schwarzen Körpers, gefolgert aus dem zweiten Hauptsatz der mechanischen Wärmetheorie. *Ann. Phys. n. F.* 48 (1893) 20; 49 (1893) 633.
- , —. Temperatur und Entropie der Strahlen. *Ann. Phys. n. F.* 52 (1894) 132.
- , — und O. Lummer. Methode zur Prüfung des Strahlungsgesetzes absolut schwarzer Körper. *Ann. Phys. n. F.* 56 (1895) 451-456.
- , —. Die Energievertheilung im Emissionsspektrum eines schwarzen Körpers. *Ann. Phys. n. F.* 58 (1896) 662-669; *Phil. Mag.* (5) 43 (1897) 214, 222.
- Wiener, O. Die Phasenänderung des Lichtes bei der Reflexion und Methoden zur Dickenbestimmung dünner Blättchen. *Ann. Phys. n. F.* 31 (1887) 629-673.



- Wiener, O. Stehende Lichtwellen und die Schwingungsrichtung des polarisirten Lichtes. *Ann. Phys.* n. F. 40 (1890) 203.
- —. Darstellung gekrümmter Lichtstrahlen und Verwerthung derselben zur Untersuchung von Diffusion und Wärmeleitung. *Ann. Phys.* n. F. 49 (1893) 105.
- Wilberforce, L. R. A new method of obtaining interference-fringes. *Trans. Cambridge Phil. Soc.* 14 11 (1887) 170-187.
- Wilczynski, E. J. Note on Schmidt's Theory of the Sun. *Astrophys. J.* 1 (1895) 112-126; 2 (1895) 69-74; *Beibl.* (1896) 32.—See Keeler. *Astroph. J.* 1 (1895) 178.
- — —. Solar Rotation. *Astrophys. J.* 4 (1896) 101-105, 310; *Astron. Nachr.* 142 (1896) 133-135.
- — —. On the depth of the Reversing Layer. *Astrophys. J.* 7 (1898) 213.
- Wild, F., und F. Harker. Einige Versuche über den Einfluss von ultraviolettem Licht auf Chlor und Wasserstoff. *Beibl.* (1897) 590.
- Wilde, H. On the spectrum of thallium and its relation to the homologous spectra of indium and gallium. *Proc. Roy. Soc.* 52 (1892-1893) 369-372; *Beibl.* (1893) 1054.
- — —. Helium and its place in the natural classification of elementary substances. *Phil. Mag.* (5) 39 (1895) 466-472; 40 (1895) 466-471.
- — —. Sur quelques nouvelles lignes spectrales de l'oxygène et du thallium. *C.-R.* 125 (1897) 708-709; *Chem. News* 76 (1897) 265, 288.
- Williams, A. S. Large versus small telescopes, and spots on Saturn. *Observat.* 19 (1896) 116-118.
- — —. On the period of the variable star, V Puppis. *Astron. Nachr.* 143 (1897) 26-27.
- Wilsing, F. Ableitung der Rotationsbewegung der Sonne aus Positionsbestimmungen von Fackeln. *Astron. Nachr.* (1888) 311-316. *Beibl.* (1889) 82.
- — —. Ueber den Lichtwechsel Algols und über die Klinkerfuss'sche Erklärung des veränderlichen Lichtes bei Sternen der III. Spectralclasse. *Astron. Nachr.* 124 (1890) 121-136; *Beibl.* (1890) 904.
- — —. Die Bestimmung von Bahnelementen enger Doppelsterne aus spektroskopischen Messungen der Geschwindigkeitskomponenten. *Astron. Nachr.* 134 (1893) 89-92; *Beibl.* (1894) 673.
- — —. Bemerkung zu dem Aufsatz des Hrn. Stratonoff: Bestimmung der Rotationsbewegung der Sonne aus Fackelpositionen. *Astron. Nachr.* 137 (1895) 385-387.

- Wilsing, J.* (Cont'd) Zur homocentrischen Brechung des Lichts in Prisma. *Ztsch. Math. u. Phys.* 40 (1895) 353-362; *Beibl.* (1896) 250.
- —. Die Lichtabsorption astronomischer Objektive und über photographische Photometrie. *Astron. Nachr.* 142 (1897) 241-251.
- —. Theoretical considerations respecting the dependence of wave-length on pressure, which Messrs. Humphreys and Mohler have observed in the arc-spectra of certain elements. *Astrophys. J.* 7 (1898) 317-329. See *Astrophys. J.* 3 (1896) 114; 4 (1896) 175, 249; 6 (1897) 169; and Godfrey, *Astrophys. J.* 8 (1898) 114.
- —. Ueber die Deutung des typischen Spektrums der neuen Sterne. *Sitzb. Berliner Akad.* (1899) 426-436; *Beibl.* (1899) 790.
- —. The effect of pressure upon the wave-lengths of the lines of the hydrogen spectrum. *Astrophys. J.* 10 (1899) 269-271.
- Wilson, E.* The law of dispersion. *Phil. Mag.* (5) 26 (1888) 385; *Jahresb.* (1888) 427.
- Wilson, W. E.* The absorption of heat in the solar atmosphere. *Astron. and Astrophys.* (1892) 46-50.
- — —. The Thermal Radiation from Sun-Spots. *Proc. Roy. Soc.* 55 (1894) 246-249; *Mon. Not.* 55 (1895) 457-462.
- — — and *G. F. Fitzgerald.* The effect of pressure in the surrounding gas on the temperature of the crater of an electric arc. *Astrophys. J.* 5 (1897) 101-108.
- Winckler, Cl.* Funkenspectrum des Germaniums. *Ber. chem. Ges.* 19 (1886) 210.
- Wind, C. H.* Die Deutung der Beugungserscheinungen bei Röntgenstrahlen. *Versl. Akad. Amsterdam* 6 (1897) 79-84; *Beibl.* (1899) 327.
- Winkelmann, A.* Die anomale Dispersion glühender Metaldämpfe und gefärbter Gläser. *Vers. deutsch. Naturf. u. Aerzte* (1887) 83; *Ann. Phys. n. F.* 32 (1887) 439-442. See *Kundt, Ann. Phys. n. F.* 10 (1880) 321.
- —. Anomale Dispersion. *Ann. Phys. n. F.* 40 (1890) 661.
- —. Handbuch der Physik. Breslau, 1894.
- Winkler, L. W.* Gesetzmässigkeit bei der Absorption der Gase in Flüssigkeiten. *Ztsch. phys. Chem.* 9 (1892) 171-176.
- Wolf, M., und Ph. Lenard.* Phosphoreszenz und Photographie. *Beibl.* (1889) 221.
- —. Das Durchmessergesetz bei photographischen Aufnahmen. *Astron. Nachr.* 126 (1890) 81-86, 354.

- Wolf, M.* Notiz über die Plejaden Nebel. *Astron. Nachr.* 137 (1895) 175.
- . Die gegenwärtige Helligkeit der Nova (T) Aurigae. *Astron. Nachr.* 142 (1897) 373.
- Wolfer, A.* Zur Bestimmung der Rotationszeit der Sonne. *Naturf. Ges. Zurich* (1896) 100-145.
- Wood, R. W.* Absorption spectrum of solutions of iodine and bromine above the critical temperature. *Phil. Mag.* (5) 41 (1896) 423-431. Beibl. (1896) 776.
- . The anomalous dispersion of Cyanin. *Phil. Mag.* (5) 46 (1898) 380-386.
- . The diffraction process of color photography. *Sci.* 9 (1899) 859-862.
- Wood, W. H.* The Local Origin of the Aurora Borealis. *Sci. Amer. Suppt.* 40 (1895) 165-169.
- Wright, W. H.* A method of correcting the curvature of lines in the spectroheliograph. *Astrophys. J.* 5 (1897) 325-327.
- . Variations in the spectra of the Orion Nebula. *Astrophys. J.* 6 (1897) 365-366.
- . The Wave-Length of the H $\beta$  Line. *Astrophys. J.* 9 (1899) 50.
- . The Orbit of  $\zeta$  Aquilae. *Astrophys. J.* 9 (1899) 59-68.
- . Observations of Comet Spectra. *Astrophys. J.* 10 (1899) 173-176.
- Wroblewsky, A.* Anwendung des Glan'schen Spektrophotometers auf die Thierchemie. *Anz. d. Krakauer Akad.* (1896) 386-390; Beibl. (1897) 513.
- Wulff, L.* Die Verwendung doppeltbrechender Krystallsubstanz. *Ztsch. f. Instrum.* 17 (1897) 292-298. Beibl. (1898) 104.
- Wulff, E. A.* Spektralapparat zur Herstellung von intensivem monochromatischen Licht. Beibl. (1899) 355-356. *N. Jahrb. Min. Beil. Bd.* (1898) 343-404.
- Wüllner, A.* Einfluss der Dicke und Helligkeit der strahlenden Schicht auf das Aussehen des Spektrums. *Ann. Phys. n. F.* 34 (1888) 647-662.—See H. Ebert, *Ann. Phys. n. F.* 33 (1888) 155-159.
- . Uebergang der Gasspectra in ihre verschiedenen Formen. *Sitzb. Berliner Akad.* (1889) 619-640; *Jahresb.* (1889) 318.
- . Die allmähliche Entwicklung des Wasserspektrums. *Sitzb. Berliner Akad.* (1889) 1113-1119.

## Y

*Yendell, Paul S.* Photographische Aufnahmen des Sternhaufens in Herkules M<sub>13</sub>. *Sirius* 22 (1895) 258-259.

———. Variable Stars. *Vjschr. d. astron. Ges.* 30 (1895) 258-280; *Astron. J.* 14 (1895) 183-184; 15 (1895) 72, 78, 92-96, 104, 153-155, 157, 173-174, 191-192; 16 (1896) 31, 32, 40, 46-47, 54, 56, 64, 78, 110, 117-118, 120, 173, 194, 202-203; 17 (1896) 12, 67-68, 79, 103, 128.

*Young, C. A.* Note on the Chromosphere Spectrum. *Nature* 45 (1891) 28; *Beibl.* (1893) 830.

———. Mr. Lowell's Theory of Mars. *Pub. Astron. Soc. Pac.* 7 (1895) 294-295.

———. Die Masse und Beschaffenheit des Saturnringes. *Sirius* 22 (1895) 249-253.

———. The "4026.5" Line and D<sub>3</sub>. *Nature* 52 (1895) 458.

———. The Reversing Stratum and its Spectrum, and on the Spectrum of the Corona. *Astrophys. J.* 6 (1897) 155.

## Z

*Zaleski, J.* Ueber das Nichtvorkommen des Argons im Blutfarbstoff. *Ber. chem. Ges.* 30 (1897) 965-967.

*Zecchini, F.* Rifrazioni atomiche degli elementi rispetto alla luce gialla del sodio. *Rend. Accad. Roma* (5) 1 (1892) 180-188; *Beibl.* (1893) 115.

———. Sopra un notevole caso di accrescimento anomalo nel potere rifrangente delle basi feneliche. *Rend. Accad. Roma* (5) 2 (1893) 491-494; *Beibl.* (1893) 1048.

———. Sul potere rifrangente del fosforo. *Gazz. chim. Ital.* 33 (1893) 97-109, 109-121; 34 (1894) 34-42; *Beibl.* (1893) 741; *Rend. Accad. Roma* (5) 2 (1893) 31-38.

———. Sul potere rifrangente delle mescolanze di due liquidi. *Gazz. chim. Ital.* 27 (1897) 358-384; *Beibl.* (1897) 732.

*Zeeman, P.* Die Bestimmung der optischen Constanten des Magnets. *Versl. Akad. Amsterdam* (1894-1895) 231; *Beibl.* (1895) 570.

———. Messung des Brechungsindex des glühenden Platins. *Vers. Akad. Amsterdam* (1895-1896) 116-119; *Beibl.* (1896) 528.

———. Metingen over de absorptie van elektrische trillingen in electrolyten. *Versl. Akad. Amsterdam* 4 (1896) 148-152; *Beibl.* (1896) 528.

- Zeeman, P.* Een experiment over de zoogenaamde voortplanting van golven. Zittversl. Akad. Amsterdam VI (1897-1898) 11-13.
- —. Over doubletten en tripletten in het spectrum, teweeggebracht door uitwendige magnetische krachten. Zitt. Akad. Amsterdam, Aft. Naturk. VI (1897-1898) 13-18, 99-102; Phil. Mag. (5) 43 (1897) 226-239, 255-259; 44 (1897) 55-61; C.-R. 124 (1897) 1444-1445; Astrophys. J. 5 (1897) 332-347.
- —. Appendice à la note: De l'influence d'un champ magnétique sur la lumière émise par un corps. Arch. néerland. 1 (1897) 217-221.
- —. Mesures concernant l'influence d'une aimantation, perpendiculaire au plan d'incidence, sur la lumière réfléchie par un miroir de fer. Arch. néerland. 1 (1897) 221-229; Phil. Mag. (5) 45 (1898) 197-201.
- —. Over eene asymmetrie in de verandering der spectrallijnen van ijzer bij straling in een magnetisch veld. Zitt. Akad. Amsterdam, Afd. Natuurk. 7 (1898-1899) 122-124; Beibl. (1898) 890; Astrophys. J. 9 (1899) 47-49.
- Zehnder, L.* Ein neuer Interferenzrefractor. Ztsch. f. Instrum. 11 (1891) 275-285; Beibl. (1892) 212.
- Zeleny, F.* On air electrified by the discharging action of ultra-violet light. Phil. Mag. (5) 45 (1898) 272-273.
- Zenger, Ch. V.* La phosphorographie appliquée à la photographie de l'invisible. C.-R. 103 (1886) 454-456; Beibl. (1887) 94.
- — —. La spectrophotographie des parties invisibles du spectre solaire. C.-R. 109 (1889) 434-436; Beibl. (1890) 37.
- — —. L'éclipsoscope, appareil pour voir la chromosphère et les protubérances solaires. C.-R. 121 (1895) 406-408; Bull. Soc. Belg. d'astron. 1 (1896) 8-12.
- Zenker, W.* Das Fransenspektroskop, ein Apparat zur Herstellung im Spektrum und zur Messung der Gangunterschiede von Lichtstrahlen. Ztsch. f. Instrum. 7 (1887) 1-7; Beibl. (1887) 442.
- —. Absorption der Sonnenwärme in der Atmosphäre. Beibl. (1888) 504.
- —. Entstehung der Farben im Lippmann'schen Spektrum. Jahrb. d. Photogr. 7 (1893) 114-121; Beibl. (1894) 568.
- —. Photographische Versuche mit Bakterium phosphorescens. Jahrb. d. Photogr. 8 (1894) 323; Beibl. (1894) 762.
- Zimanyi, K.* Hauptbrechungsexponenten der wichtigeren gesteinebildenden Mineralien bei Natriumlicht. Ber. aus Ungarn 11 (1893) 189-232.

*Zsigmondy, R.* Die Löslichkeit der Sulfide in Glas (neue Farben).

† Ding. pol. J. 273 (1889) 29–37; Beibl. (1889) 682.

———. Absorption der strahlenden Wärme durch Flüssigkeiten.

Ann. Phys. n. F. 57 (1895) 639–645.

*Zoppelari, F.* Sulla rifrazione atomica del selenio. Gazz. chim. Ital.

2 (1894) 396–408; Rend. Accad. Roma 3 (1894) 330–339; Beibl.

(1895) 487.

*Zwiers, H. F.* Eine neue Methode zur Bestimmung der Doppelstern-

bahnen. Astron. Nachr. 139 (1896) 369–379.

## PART II.—SUBJECT-INDEX.

### HISTORY.

- Bequerel, E.* C.-R. 112 (1891) 331.  
*Berthelot, M.* C.-R. 106 (1888) 443-446; Beibl. 12 (1888) 362.  
*Bibliography of Spectroscopy*, published by Dr. Herbert McLeod in the Reports of the British Association, continued to the end of 1899. Similar to this work, but with much fewer classifications.  
*Clark, Alvan Graham.* Obituary, *Astrophys. J.* 6 (1897) 136.  
*Cornu, A.* Ann. Bur. Long. (1896) 1. (Fresnel.)  
*Fizeau, A. H. L.* Obituaries, C.-R. 123 (1896) 471; *Astrophys. J.* 4 (1896) 367.  
*Hilger, Adam.* Obituary, *Astrophys. J.* 6 (1897) 139.  
*Janssen, J.* C.-R. 117 (1893) 77-80; Beibl. 18 (1894) 94.  
*Kahlbaum, G. W.* Beibl. 12 (1888) 335 Abs.  
*Kayser, H.* Chem. News 74 (1896) 307 Abs.  
*Newton, Hubert A.* Obituary, *Astrophys. J.* 4 (1896) 236.  
*Nobile, A.* Obituary, *Astrophys. J.* 6 (1897) 139.  
*Preyer, W.* Ztsch. Psychol. u. Physiol. 11 (1896) 405.  
*Ramsay, W.* Macmillan: London, 1896. (Hist. Gases.)  
*Ranyard, A. C.* Obituary, *Astrophys. J.* 1 (1895) 168.  
*Rayleigh, Lord.* (Radiant Energy.) Phil. Mag. (5) 27 (1889) 265-270; Beibl. 13 (1889) 495.  
*Rouland, H. A.* Chem. News 63 (1891) 133-134.  
*Russell, S. M.* Observ. 18 (1895) 430-433.  
*Rutherford, L. M.* Obituary, Nat. Acad. Sci. April, 1895.  
*Seidel, L. P. von.* Obituary, Astron. Nachr. 141 (1896) 319.  
*Spoerer, F. W. G.* Obituary, *Astrophys. J.* 2 (1895) 239.  
*Stevens, W. L.* Amer. J. Sci. (3) 50 (1895) 377-386.  
*Stone, E. J.* *Astrophys. J.* 6 (1897) 138.  
*Tisserand, F. F.* Obituary, 4 (1896) 368.  
*Trouvelot, E. L.* *Astrophys. J.* 2 (1895) 166.  
*Tuckerman, A.* (Bibliography.) Smithsonian Miscell. Coll. No. 658 (1888) 423 pp.; Beibl. 13 (1889) 836; Amer. J. Sci., Nov. 1888.



*Waderman, S.* (Said to have introduced spectroscopic analysis into the practice of medicine in the United States in 1868.) *Obituary. New York Times* of March 17, 1899.

*Watts, W. Marshall.* (Index, revised and enlarged.) *Manchester*, 1889, 232 pp.; *Beibl.* 14 (1890) 146. *Appendix F., Manchester*, 1895, 22 pp.

## BOOKS.

*Ames, J. S.* (Harper's Sci. Mem.) *New York*, 1898.

*Berthelot, M.* *Oeuvres.* *Paris*, 1896.

*Berthold, G.* (Sun spots.) *Leipzig*, 1894.

*Bibliography of Spectroscopy* (Dr. McLeod's). in the *British Assoc. Repts.*, also published separately. to the end of 1899.

*Bochendorff, W.* (Absorp. Sp.) *Diss.*, *Erlangen*, 80 pp., 1890; *Beibl.* (1891) 716.

*Brester, A.* (Sun.) *Amsterdam Akad. Verh.* (1892) 168 pp.

*Breuer, A.* (Dispersion.) *Erfurt*, 1891. 54 pp.; *Beibl.* (1892) 273.

*Cazin, A.* *Paris*, 1878, 12mo.

*Engelmann, Th. W.* (Tables.) *Leipzig*, 1897; review in *Phys.* (1898) 183.

*Fraunhofer, Jos. von.* *Werke*, ges. von E. Lommel, *Muenchen*, 1888, 310 pp.

*Gramont, A. de.* (Minerals.) *Paris*, 1897, 207 pp.; *Astrophys. J.* 5 (1897) 362 Abs.

*Helmholtz, R. von.* (Gases.) *Berlin*, 1890, 79 pp.

*Henocque, A.* (Blood Sp.) *Paris*, 1895, 200 pp. av. fig.

*Julius, W. H.* (Gases.) *Berlin*, 1890, 86 pp. 4 Taf. 4to.; *Beibl.* (1890) 602.

*Kayser, H.* (Lehrbuch.) *Stuttgart*, 1890. 464 pp.

— —. (Handbuch d. Spectroscopie.) *Leipzig: Hirzel*, 1899, Bd. I., 750 pp.

*Konkoly, R.* (Handbuch.) *Halle*, 1898, 568 pp.

*Kruess, G. und H.* *Hamburg*, 1891, 8vo, ill.

*Landauer, Joh.* *Spectralanalyse.* *Braunschweig*, 1896, 174 pp.; *New York*, 1896 (transl.); *Astrophys. J.* 4 (1896) 158.

*Lefèvre, J.* *Spectroscopie.* *Paris*, 1896, 188 pp.; *Astrophys. J.* 4 (1896) 156.

— —. *Spectrométrie.* *Paris*, 1896, 212 pp.; *Astrophys. J.* 4 (1896) 156.

*Lohse, O.* (Violet Metal. Sp.) *Berlin Akad.* 1897, 8vo, 29 pp.

*Mascart, M.* *Optique.* *Paris*, 1889, 638 pp.; *Beibl.* (1889) 834.

- Mascart, M.* Do., Tome II. Paris: Gauthier-Villars, 1891, vi et 643 pp., 8vo. .
- . Do., Tome III. Paris. Gauthier-Villars, 1893, 696 pp., 8vo.
- Mendelejeff, D.* Chemie, uebersetzt. St. Petersburg, 1891, 8vo.
- Nodon, A.* (Infra Red) Paris, 1897, 22 pp., 8vo.
- Ostwald, W.* Chemische Energie. Leipzig, 1892, 528 pp.
- Poincaré, H.* Mathem Theorie d. Lichts. Berlin, 1894, gr. 8vo, 295 pp
- Ramsay, W.* Gases. London: Macmillan, 1896, viii-240 pp., with portraits.
- Roscoe, H. E., and Schorlemmer, C.* Chemistry. London and New York, 1878-1892, 9 vols., roy. 8vo. Ill.
- Salet, G.* Spectroscopie. Paris, 1888, 240 pp.; Beibl. (1891) 674.
- Scherner, J.* Sp. Anal. d Gestirne. Leipzig, 1890, 474 pp. Translated and enlarged by E. B. Frost. Boston, 1894, 482 pp.; Phys. Rev. (1895) 308.
- Sidersky, D.* Constantes phys.-chem. Paris, 1898.
- Stanley, W. F.* Nebular Theory. London, 1895, 260 pp. Astrophys. J. 4 (1896) 159.
- Thompson, S. P.* Light. London, 1898, 294 pp. Beibl. (1898) 263, 618. Translated into German by O. Lummer, Halle, 1898, 229 pp.
- Tuckerman, A.* Index to Spectroscope. Smithsonian Misc. Coll. No. 658, 1888, 423 pp.; Ann. Phys. Beibl. (1889) 836; Amer. J. Sci. Nov. 1888.
- Valenta, E.* Photogr. in nat Farb. Halle, 1894, 82 pp
- Vogel, H. W.* Spectralanalyse 2e Aufl. Berlin, 1889, 515 pp.; Beibl. (1889) 257.
- Watts, W. M.* Index of Spectra. Manchester: A. Heywood, 1889-1899, 232 pp.; Beibl (1890) 146.
- Winkelmann, A.* Physik. Breslau, 1894, 2er Bd. Optik.

## SPECTROSCOPY IN GENERAL.

- Abney, W. de W.* Visibility. Proc. Roy. Soc. 49 (1891) 509.
- Askenasy, P., und V. Meyer.* Liebig's Ann. 267 (1892) 72.
- Aymonnet, F.* C.-R. 117 (1893) 304-306; Beibl. (1893) 1057.
- Beltrami, E.* Rend. Accad. Roma (5) 1 (1892) 99-108; Beibl. (1890) 496.
- . Rend. Accad. Roma (4) (1895) 51-52.
- Bibliography of Spectroscopy*, to end of 1899, Repts. Brit. Assoc.

- Bichat, E.* Fringes de Talbot. *Arch. de Genève* 25 (1891) 5-8.
- Boisbaudran, F. Lecoq de.* Classification. *C.-R.* 120 (1895) 105  
1104; 124 (1897) 127-130.
- Broca, A.* Achromatisme. *C.-R.* 114 (1892) 216-220.
- . Variations. *Rev. gén. Sci.* 8 (1897) 935-939.
- Bruehl, J. W.* Stereo-chem. Vers. *Ztsch. phys. chem.* 21 (1895)  
385-413; *Beibl.* (1897) 224-226.
- Bury, O.* Exchanges. *Ann. Phys. n. F.* 52 (1894) 205.
- Campbell, W. W.* Astrophys. J. 5 (1897) 233-242.
- Cantoni, M.* Action at a distance. *Rend. Accad. Roma* (1890) 37  
383.
- Cerri, A.* *Beibl.* (1897) 226.
- Cesaro, G.* *Ann. Soc. géol. Belgique*, 17 Mem. (1890) 93-97.
- Charpentier, A.* Perception of rays. *C.-R.* 114 (1892) 1423-1424  
*Beibl.* (1893) 657.
- . *C.-R.* 124 (1897) 356-359; *Beibl.* (1898) 407.
- Chwolson, O.* *Repert. d. Phys.* 24 (1888) 291-293.
- Clarke, F. W.* Constants. Washington, 1888, 8vo, 409 pp.
- Cornu, A.* White Light. *C.-R.* 116 (1893) 711; *Beibl.* (1893) 107
- . Wave Theory. *Nature* 60 (1899) 292-297.
- Cotton, A.* Kirchhoff's Law. *Astrophys. J.* 9 (1899) 237-268.
- Croft, W. B.* Newton's Scale. *Proc. Phys. Soc. Dec.* 16, 189  
*Beibl.* (1893) 1072.
- Crookes, W.* Genesis of the Elements. *Roy. Inst. Gt. Brit.* Feb. 1  
1887; Translated into German, Braunschweig, 1888, 35 pp.
- . *Proc. Roy. Soc.* 40 (1886) 77; *Jahresb.* (1886) 307.
- Demarçay, E.* *Rev. gén. Sci. nat.* 4 (1893) 725-729; *Beibl.* (189  
339.
- . Radio-active Sub's. *C.-R.* 127 (1898) 1218; *Chem. News*  
79 (1899) 13; *Beibl.* (1899) 195.
- Deslandres, H.* Periodic Variations. *C.-R.* 110 (1890) 748-759.
- Dewar, J.* *Proc. Roy. Soc. Inst.* (1887) 11 pp.; *Beibl.* (1889) 79.
- Donnan, F. G.* *Nature* 54 (1896) 55.
- Drude, P.* *Goett. Nachr.* (1892) 366-412.
- . *Ann. Phys. n. F.* 50 (1893) 381.
- Ebert, H.* *Sitzb. phys. med. Soc. Erlangen* (1888) 8 pp.; *Beibl.* (188  
942.
- . Theory of Light. *Beibl.* (1891) 642, 643.
- . *Beibl.* (1896) 40.
- Edser, E., and C. P. Butler.* *Phil. Mag.* (5) 46 (1898) 207-216; *Chem*  
*News* 77 (1898) 260.

- Englisch, E.* Bunsen-Roscoe Law. Verh. deutsch. Naturf. II 1 (1899) 171-172.
- Exner, K.* Fresnel-Huyghen Principle. Berlin Akad. Ber. (1889) 51-54.
- Fessenden, R. A.* Franklin Inst 140 (1896) 187-216.
- Fitzgerald, G. F.* Astrophys J 5 (1897) 210.
- Galitzin, Furst B.* Ann Phys. n. F. 56 (1895) 78-99, Astrophys. J. (1895) 324.
- Garbasso, A.* Atti Accad. Torino 30 (1895) 100-107; Beibl. (1895) 488.
- e *Alberto.* Nuovo Cim. (4) 6 (1897) 313-323; Bibl. (1898) 399.
- Glan, P.* Ann. Phys. n. F. 58 (1896) 151-153.
- Wiener Anzeiger (1898) 216.
- Gortz, A.* Diss., Tuebingen, 1892, 57 pp.
- Gouy* Ann. chim. phys. (6) 16 (1889) 262-289.
- Govi, G.* Nuovo Cimento (3) 24 (1888) 234-242.
- Gramont, A. de* Bull. Soc. chim. Paris (3) 17-18 (1897); Chem. News 76 (1897) 277.
- Greenwich Observatory Results*, 1888-1899.
- Grunwald, A.* Chemiker Ztg. 14 (1889) 4 pp.—See Kayser, Do. 13 (1889) 1655, 1687.
- Sitzb. Wiener Akad. 98 IIa (1889) 785-817; Beibl. (1890) 278.
- Gutzmann, A.* J. reine u. angewandte Math. 114 (1894) 333-337.
- Hamy, M.* C.-R. 128 (1899) 1380-1384.
- Hartley, W. N.* Phil Mag. (5) 31 (1891) 359-363; Beibl. (1891) 514.
- — — Proc. Roy. Soc. 55 (1895) No. 334, Astrophys. J. 1 (1895) 88, Abs.
- — — Proc. Roy. Soc. 60 (1896) 216-221.
- — — and *H. Ramage.* Chem. News 77 (1898) 121-122; Beibl. (1898) 559.
- Hartmann, J.* Leipzig: Engelmann, 1898, gr. 4to, 25 pp.; Beibl. (1899) 175.
- Hasselberg, B.* K. Svensk. Akad. Handl. 24 (1892) 45 pp.; Beibl. (1892) 738.
- Heen, P. de.* Ciel et Terre 17 (1896) 363-369.
- Henry, Ch.* C. R. 122 (1896) 1139-1142.
- Herschel, A. S.* Nature 55 (1897) 271.
- Hoeffler, F.* Inaug. Diss., Zurich, 1895, 49 pp.
- Holtz, W.* Ztsch. phys. u. chem. Unterr. 8 (1894) 1-10; Beibl. (1895) 168.

- Huggins, Sir W., and Lady Huggins.* *Astrophys. J.* 6 (1897) 322-327.
- Hurion, A.* *C.-R.* 112 (1891) 1491-1434; *Beibl.* (1891) 647.
- Husmann, A.* *Ztsch. phys. u. chem. Unterr.* 5 (1896) 237-238.
- Janssen, J.* *C.-R.* 105 (1887) 325-328.
- . *C.-R.* 111 (1890) 431-447; *Beibl.* (1891) 35.
- . *C.-R.* 115 (1893) 419-423.
- Julius, V. A.* *Ann. École polytechn. Delft* 5 (1889) 1-117; *Beibl.* (1890) 40.
- Kalähne, A.* *Ann. Phys. n. F.* 65 (1898) 815-848.
- Kanonnikoff, J.* *J. russ. phys. chem. Ges.* 30 (1899) 965-975; *Beibl.* (1899) 768.
- Kayser, H.* See Grünwald. *Chemiker Ztng.* 13 (1889) 1655, 1687; *Beibl.* (1890) 278.
- . *Handbuch*, Bd. I. Leipzig, 1900, 750 pp.
- und *Runge, C.* I. *Berlin Akad. Abhandl.* (1888) 93 pp; II, *Do.* (1889) 45 pp.; III, *Do.* (1890) 66 pp.; IV, *Do.* (1891) 72 pp.; V, *Do.* (1891) 177 pp.; VI, *Do.* (1892) 28 pp., 4to.
- , ———. *Ann. Phys. n. F.* 52 (1894) 114; *Astrophys. J.* 1 (1895) 90 Abs.
- Kehrmann, Fr.* *Chem. Ztng.* 14 (1890) 508, 527, 541; *Beibl.* (1890) 618.
- . *Verh. deutsch. Naturf. u. Aerzte* II 1 (1899) 89-91.
- Kelvin, Lord.* *Phil. Mag.* (5) 46 (1898) 494-500.
- . *Proc. Roy. Inst. Gt. Brit.* (1899) 1-4; *Beibl.* (1899) 772.
- Kerber, A.* *Centralztng. f. Opt. u. Mech.* 12 (1891) 121, 133, 145, 158; *Beibl.* (1892) 148.
- . *Dioptrik.* Leipzig, 1898.
- Kerber, F.* *Himmel u. Erde* 11 (1899) 26-37, 69-86, 122-127, 171-183; *Beibl.* (1899) 177.
- König, A.* *Ztsch. Psychol. u. Physiol.* 8 (1894) 375-380; *Beibl.* (1895) 642.
- . *Sitzb. Berliner Akad.* (1896) 945-949; *Beibl.* (1897) 423.
- König, W.* *Ber. sächs. Ges. Wiss.* (1890) 46-54.
- Köttgen, E.* *Ann. Phys. n. F.* 53 (1894) 793-811; *Astroph. J.* 2 (1895) 82.
- Kövesligethy, E. von.* *Naturwiss. Ber. Ungarn* 7 (1889) 24-35; *Beibl.* (1890) 116.
- . *Halle a. S.*, 1890, 327 pp.; *Beibl.* (1890) 852.
- Krüss, H.* *Abhandl. naturw. Ver. Hamburg* 11 (1889) 1-28; *Beibl.* (1890) 372.
- u. *G.* *Hamburg*, 1891, 291 pp.; *Beibl.* (1892) 606.

- Kruss, H., u. G.* Ztschr. anorg. Chem. 10 (1895) 31-43; Beibl. 20 (1896) 26.
- . Verh. deutsch. Naturf. u. Aerzte II 1 (1896) 76-77.
- Ladd, Ch. F.* Ztsch. Psychol. u. Physiol. 4 (1892) 211-222.
- Langley, S. P.* Sudden Phenomena. Amer. J. Sci. (3) 37 (1889) 93-100.
- . Smithsonian Astrophysical Observatory Repts. 1888-1899.
- Larmor, J.* Rept. Brit. Assoc. (1890) 742; Beibl. (1892) 526.
- Lemoine, G.* C.-R. 112 (1891) 992-995, 1124-1127.
- Liesegang, R. E.* J. prakt. Phys. 6 (1893) 48-54; Beibl. (1894) 341.
- Living, G. D.* Benham's Artificial Sp. Cambridge Proc. 8 IV (1895) 249.
- and *J. Dewar.* Dust. Proc. Roy. Soc. Lond. 48 (1891) 437-440.
- Lockyer, J. N.* Shifting of lines. Nature 53 (1895) 415-417.
- . Present standpoint. Nature 59 (1898) 585.
- . Stellar. Chem. News 79 (1899) 145-147; Beibl. (1899) 792.
- . Recent advances. Nature 60 (1899) 103-108.
- Lodge, O.* Proc. Roy. Soc. 61 (1897) 31-32; Beibl. (1897) 406, 508.
- Lord, H. C.* Curvature. Astrophys. J. 5 (1897) 348-350.
- Lorentz, H. A.* (Gen.) Versl. k. Akad. Amsterdam 4 (1896) 176-187.
- Love, A. E. H.* Fourier's Series. Nature, 58 (1898) 569.
- Love, E. F. J.* Phil. Mag. (5) 25 (1888) 1-6; Beibl. (1888) 348.
- Lumière, Aug. et L.* C.-R. 128 (1899) 359-361.
- McCowan, J.* Ridge Lines. Phil. Mag. (5) 37 (1894) 227-237.
- MacDonald, J. D.* Analogy with sound. Proc. Roy. Soc. 52 (1892-1893) 375.
- Mach, L.* Optische Unters. Wiener Anzeiger (1893) 198-200.
- Matthiessen, L.* Die Phoronomie. Repert. d. Physik. 25 (1889) 663-684.
- Meisel, F.* Ellipsoidische Isophoten. Repert. d. Phys. 26 (1890) 58-64.
- Michelson, A. A.* Amer. J. Sci. (4) 3 (1897) 475-478; Beibl. (1897) 729.
- . Fourier's Series. Nature 58 (1898) 545 —See Love, 569.
- Morera, G.* Huyghens's Principle. Nuovo Cim. (4) 2 (1895) 17-26.
- Murphy, D. W.* Fresnel's Formulae. Ann. Phys. n. F. 57 (1896) 593-603.

- Nadini, V.* *Variatione Formale.* *Rend. Accad. Roma* 6 (1890) 324-331.
- Norwegian Polar Expedition.* *Nature* 35 (1895) 515-516.
- Ostwald, W.* *Chem. Fernwirkung.* *Ztsch. physikal. Chem.* 9 (1892) 542-553.
- Paschen, F.* (Laws of spectra.) *Astrophys. J.* 2 (1895) 202-211.
- — —. (Do.) *Ann. Phys. n. F.* 55 (1896) 455-492; 60 (1897) 662-723; *Astrophys. J.* 5 (1897) 50-53. Abs. by H. Crew.
- Petersson, O.* *Kare Earths.* *Bihang k. Svensk Akad. Handl.* 21 (1895) 16 pp.
- Pieri.* *Atti Accad. Torino* 27 (1890-1891) 239-245; Beibl. (1892) 605.
- Poincaré, H.* Paris. 1889. 408 pp.; Beibl. (1890) 84.
- Preston, Th.* *Theory of Light.* London. 1890. 465 pp.
- Preyer, W.* *Genetische System.* *Verh. phys. Ges. Berlin* 10 (1891) 85-88.
- Raveau, C.* *Théorie.* C.-R. 112 (1891) 853-855.
- Rayleigh, Lord.* *Aberration.* *Nature* 45 (1892) 499; Beibl. (1892) 604.
- Reiff, K.* *Ann. Phys. n. F.* 50 (1893) 361.
- Riecke, E.* (Dynamics of a Sp.) *Physikal. Ztschr.* 1 (1899) 10.
- Roscoe, H. E., und A. Schuster.* *Sechs Vorlesungen.* Beibl. (1890) 856 Abs.
- Rowland, H. A.* *Gratings.* *Rept. Brit. Assoc.* (1888) 566.
- — — —. *Recent Progress.* *Chem. News* 63 (1891) 133; Beibl. (1891) 513.
- Runge, C.* *Coincidences.* *Phil. Mag.* (5) 29 (1890) 462-466; Beibl. (1890) 781.
- — — and *G. J. Stoney.* *Line-Spectra.* *Nature* 46 (1892) 29, 100, 126, 200, 222, 247, 268; Beibl. (1894) 559.
- — —. (Ein Gesetz.) *Astron. and Astrophys.* 13 (1894) 128-130; Beibl. (1895) 173.
- — —. *Line-Spectra.* *Nature* 52 (1895) 106-108; Beibl. (1896) 530.
- Rydberg, J. R.* (Line-Spectra.) *Ztsch. physikal. Chem.* 5 (1890) 227-232.
- — — —. Do. *Oefvers k. Akad. Stockholm* (1893) 677-693.
- — — —. (Series.) *Verh. Deutsch. Naturf. u. Aerzte* II 1 (1896) 53.
- Sagnac, G.* (Transformation of rays.) *Bull. Soc. franc. de phys.* (1899) 1.
- Saija, G.* *Mem. Spettr. Ital.* 28 (1899) 19-22.



- Salet, G.* (Stokes's Law.) C.-R. 115 (1892) 283-284; Beibl. (1892) 741.
- Saltzmann, W.* Ztsch. phys. chem. Unterr. 4 (1892) 189-191; Beibl. (1892) 734.
- Saussure, R. de.* Théorie. Arch. de Genève 25 (1891) 105-128, 170-193.
- Schmidt, A.* Sonnentheorie. Sirius (1895) 10 pp.
- Schuster, A.*, and *Lord Rayleigh.* (Gases.) Rept. Brit. Assoc. (1895) 610.
- Schutze, M.* Color. Ztsch. phys. Chem. 9 (1892) 109 136; Beibl. (1892) 428.
- Spring, W.* (Temperature) Bull. Acad. Belgique (3) 31 (1896) 94-110, 256 260; Beibl. (1896) 536, 597; Arch. de Genève (4) 1 (1896) 201-219.
- Stas, F. S.* (Gen.) Chem. News 72 (1895) 177-179, 188 190, 192-193, 203-205, 215, 226-227, 239-241, 248-250, 259 261, 274-277, 284-286, 301-304, 311-313; 73 (1896) 5, 15, 29, 39, 51, 66, 80, 113, 124, 135, 147, 159, 171, 183, 192, 204, 216, 224, 241, 249, 263 (concluded).
- Stewart, R. W.* Doppler's Principle. Nature 43 (1891) 80; Beibl. (1891) 198.
- Stoney, G. J.* Line-Spectra. Nature 46 (1892) 200, 222.
- . Recent Sp. Nature 46 (1892) 513; Beibl. (1893) 799.
- . Groups of Lines Rept. Brit. Assoc. (1895) 610-612; Beibl. (1896) 691.
- . Molecules. Proc. Roy. Soc. 58 (1895) 177-182.
- . Line-Spectra. Chem. News 72 (1896) 225; Beibl. (1896) 531.
- . Perturbation. Nature 59 (1899) 294; Beibl. 23 (1899) 300.
- Straubel, R.* Refraction. Ann. Phys. n. F. 56 (1895) 746-761.
- Strehl, K.* Ztsch. Opt. u. Mech. 16 (1895) 203; Beibl. (1896) 125.
- Thiele, T. N.* Spectral Series. Astrophys. J. 6 (1897) 65-76; Beibl. (1898) 34.
- Umhirs, O.* Ann. Phys. n. F. 38 (1889) 640-663; Ber. Wiener Akad. 98 (1889) 826-851.
- Vogel, H. W.* Notizen. Ber. chem. Ges. 21 (1888) 2029-2032; Beibl. (1888) 786.
- . Spectralanalyse. I. Theil, Berlin, 1889, 516 pp.
- Voigt, W.* Ann. Phys. n. F. 35 (1888) 370-397, 524-552.
- Volkmann, P.* Vorlesungen. Leipzig, 1891, 432 pp.

— — — — — *Vierteljahrsschrift der Naturforschenden Gesellschaft in Zürich* 1891-1892. 232 pp., 8vo.

— — — — — *Monatsh. Chem. Phys.* 1891-1892. 232 pp., 8vo.  
 — — — — — *Monatsh. Chem. Phys.* 1893-1894. 232 pp., 8vo. Beibl. (1893)

— — — — — *Monatsh. Chem. Phys.* 1895-1896. 232 pp., 8vo.

— — — — — *Monatsh. Chem. Phys.* 1897-1898. 232 pp., 8vo. 1897: 287-307;  
 Beibl. 1897: 1-6.

— — — — — *Monatsh. Chem. Phys.* 1899-1900. 232 pp., 8vo. II: (1897) 66.

— — — — — *Monatsh. Chem. Phys.* 1901-1902. 232 pp., 8vo. 1901: 1-6.

### LIST OF THE SPECTROSCOPIC

— — — — — *Monatsh. Chem. Phys.* 1891-1892. 232 pp., 8vo. Ultra-  
 violet.

— — — — — *Monatsh. Chem. Phys.* 1893-1894. 232 pp., 8vo.

— — — — — *Monatsh. Chem. Phys.* 1895-1896. 232 pp., 8vo.

— — — — — *Monatsh. Chem. Phys.* 1897-1898. 232 pp., 8vo. 1897: 2065-2070.

— — — — — *Monatsh. Chem. Phys.* 1899-1900. 232 pp., 8vo. 1899: 331-352; Beibl.  
 1899: 1-6.

— — — — — *Monatsh. Chem. Phys.* 1901-1902. 232 pp., 8vo. 1901: 1-6; Beibl. (1899)  
 1-6.

— — — — — *Monatsh. Chem. Phys.* 1903-1904. 232 pp., 8vo.

— — — — — *Monatsh. Chem. Phys.* 1905-1906. 232 pp., 8vo.

— — — — — *Monatsh. Chem. Phys.* 1907-1908. 232 pp., 8vo. 1907: 121-129; Beibl.  
 1907: 1-6.

— — — — — *Monatsh. Chem. Phys.* 1909-1910. 232 pp., 8vo. 1909: 505-571, 654;  
 Beibl. 1909: 1-6.

— — — — — *Monatsh. Chem. Phys.* 1911-1912. 232 pp., 8vo.

— — — — — *Monatsh. Chem. Phys.* 1913-1914. 232 pp., 8vo. 1913: 14; Beibl. 1913: 1-6.

— — — — — *Monatsh. Chem. Phys.* 1915-1916. 232 pp., 8vo. 1915: 287.

— — — — — *Monatsh. Chem. Phys.* 1917-1918. 232 pp., 8vo. 1917: 740.

— — — — — *Monatsh. Chem. Phys.* 1919-1920. 232 pp., 8vo. 1919: 282-284.

— — — — — *Monatsh. Chem. Phys.* 1921-1922. 232 pp., 8vo. 1921: 270-257.

— — — — — *Monatsh. Chem. Phys.* 1923-1924. 232 pp., 8vo. 1923: 257-279.

— — — — — *Monatsh. Chem. Phys.* 1925-1926. 232 pp., 8vo. 1925: 801-804.

— — — — — *Monatsh. Chem. Phys.* 1927-1928. 232 pp., 8vo. 1927: 58-04.

— — — — — *Monatsh. Chem. Phys.* 1929-1930. 232 pp., 8vo. 1929: 661-663; Beibl. (1894) 338.

— — — — — *Monatsh. Chem. Phys.* 1931-1932. 232 pp., 8vo. 1931: 74-115.

— — — — — *Monatsh. Chem. Phys.* 1933-1934. 232 pp., 8vo. 1933: 69-81.

— — — — — *Monatsh. Chem. Phys.* 1935-1936. 232 pp., 8vo. 1935: 32.

— — — — — *Monatsh. Chem. Phys.* 1937-1938. 232 pp., 8vo. 1937: 80 pp.

- Bastwick, A. E.* Amer. J. Sci. (3) 37 (1889) 471-473; Beibl. (1889) 814.
- Bouasse, H.* Ann. chim. phys. (6) 28 (1893) 145-237, 433-498; Beibl. (1894) 203.
- Boumann, Z. P.* Zittingsv. Amsterdam 5 (1896-1897) 438-442; Beibl. (1897) 589.
- Branly, E., et G. Le Bon.* C.-R. 128 (1899) 879-882.
- Bremer, H.* Diss., Erlangen, 1890, 14 pp.; Beibl. (1891) 768.
- Brillouin, M.* C. R. 115 (1892) 808 811.
- Brun, A.* Arch. de Genève 28 (1892) 410 413; Beibl. (1893) 335.
- Brunhes, B.* C. R. 120 (1895) 1041-1044.
- — J. de phys. 5 (1896) 12-22.
- Buguet, A.* C.-R. 125 (1897) 375-377.
- Burke, J.* Rept. Brit. Assoc. (1896) 731.
- — Proc. Roy. Soc. 61 (1897) 485-487; Phil. Trans. 191 (1898) 87-104.
- Camichel, Ch.* C.-R. 117 (1893) 307-309.
- — Thèse, Paris, 1895, 67 pp. 4to.; Beibl. (1896) 129.
- Carrara, G. e A. Minozzi* Gazz. chim. Ital 27 (1897) 455-467; Beibl. (1898) 560.
- Carvallo, E.* C.-R. 112 (1891) 431-433.
- — C.-R. 114 (1892) 661-664.
- — Ann. chim. phys. (6) 7 (1896) 58-94; C.-R. 122 (1896) 985-988.
- Colnet d'Huart.* Luxembourg, 1890, 8vo, 106 pp.; Beibl. (1891) 348.
- Conroy, J.* Proc. Phys. Soc. Feb. 15, 1891; Phil. Mag. (5) 31 (1891) 317-320.
- Cotton, A.* C.-R. 120 (1895) 989-991.
- — Thèse, Paris, 1896, 99 pp.; Beibl. (1896) 882; Ann. chim. phys. 8 (1896) 347-432.
- — C.-R. 127 (1898) 953-955.
- Crookes, W.* Chem. News 60 (1889) 27.
- Crova et Compan.* C.-R. 126 (1898) 707-710.
- Deslandres, H.* C. R. 121 (1895) 886 887.
- Detlefsen, E.* Beibl. (1889) 681.
- Dewar, J.* Proc. Roy. Soc. May 12, 1898.
- — Proc. Chem. Soc. (1898) 146.
- Dimmer, G.* Didymium. Sitzb. Wiener Akad. 106 (1897) 1087-1102; Anzeiger (1897) 254.
- Dobeneck, A. von.* Bodenconstituenten. Diss., Rostock, 1892, 66 pp.
- Donath, B.* Ann. Phys. n. F. 58 (1896) 609-661.

- Donnan, F. G.* Ztsch. physikal. Chem. 19 (1896) 465-488.
- Du Bois, H. E. & G.* Verh. deutsch. Naturf. u. Aerzte 64 (1891) 50.
- — — — — u. *H. Rubens.* Ann. Phys. n. F. 47 (1892) 203.
- Dudley, W. L.* Chem. News 66 (1892) 163-165.
- Eder, J. M.* Verh. deutsch. Naturf. u. Aerzte II (1895) 78.
- — — — — u. *E. Valenta.* Jahrb. f. Phot. u. Reprod. (1895) 310-327.
- Edler, J.* Diss., Greifswald, 1889, 54 pp.
- Ehlers, J.* Diss., Göttingen, 1897; Beibl. (1898) 157.
- Elster, J., u. H. Geitel.* Ann. Phys. n. F. 61 (1897) 445-465.
- Étard, A.* C.-R. 120 (1895) 1057-1060.
- Ewan, Th.* Phil. Mag. (5) 33 (1892) 317-342.
- — — — — Proc. Roy. Soc. 56 (1894) 286-288; 57 (1895) 117-161.
- Festing, et al.* Rept. Brit. Assoc. (1889) 227-228.
- Fievez, Ch., et E. van Aubel.* Bull. Acad. roy. Belg. (3) 17 (1889) 102-104.
- Forsling, S.* Bih. Svensk. Akad. Handl. 18 I (1892) 23 pp.; Beibl. (1894) 562.
- — — — — Bih. Svensk. Akad. Handl. 23 I (1898) No. 5; Beibl. (1899) 484.
- — — — — Bih. Svensk. Akad. Handl. 24 II (1898) 1-35.
- Friedel, Ch.* Ann. Phys. n. F. 55 (1895) 453-478.
- Frohlich, O.* Meteorol. Ztschr. 5 (1888) 382-390; Beibl. (1889) 504.
- — — — — Meteorol. Ztschr. 6 (1889) 78; Beibl. (1889) 687.
- Gamgee, A.* Proc. Roy. Soc. 49 (1896) 276-279; Beibl. (1896) 650, 696.
- Gladstone, J. H., and W. Hibbert.* Chem. News 78 (1898) 199-300.
- Goldhammer, D.* J. russ. phys. chem. Ges. 24 (1892) 17-39.
- Graebe, H.* Diss., Dorpat, 1892; Beibl. (1896) 127.
- Grosse, W.* Ztsch. Instrum. 9 (1889) 1-9; Beibl. (1889) 679.
- Hallwachs, W.* Gott. Nachr. (1889) 99 pp.
- Hartinger,* Monatsh. f. Chem. 12 (1891) 362-367.
- Hartley, W. N.* J. Chem. Soc. (1888) 641-663.
- — — — — Chem. News 79 (1899) 101.
- — — — — and *J. J. Dobbie.* J. Chem. Soc. 73 (1898) 598-606.
- — — — — J. Chem. Soc. 74 (1899) 640-661.
- Hasselberg, B.* Mem. Acad. St. Petersbourg (7) 36 (1889) 50 pp.; Beibl. (1889) 813; Jahresb. (1889) 318.
- — — — — Svensk. Akad. Handl. 24 (1893) 53 pp.; Beibl. (1894) 339.
- Hausdorff, F.* Diss., Leipzig, 1895. 83 pp.; Beibl. (1895) 888.
- Henrich, F.* Ztsch. physikal. Chem. 9 (1892) 435-444.
- Hepperger, J. von.* Sitzb. Wiener Akad. 105 IIa (1895) 173-227.

- Higgs, G. Proc. Roy. Soc. 54 (1893) 200-209.  
Horn, G. Diss., Göttingen, 1898, 72 pp.; Beibl. (1899) 183.  
Hubl, A., *Freiherr von* Jahrb. f. Photogr. u. Reprod. (1897) 56-59.  
Humphreys, W. J. Phil. Mag. (5) 44 (1897) 401-404.  
Hurmuzescu, D. Eclair. electr. 15 (1898) 166-168.  
Hutchins, C. C. Amer. J. Sci. (3) 43 (1892) 558-559; Phil. Mag. (5) 34 (1892) 141.  
— — — Amer. J. Sci. (4) 6 (1898) 61-64.  
Janssen, J. C.-R. 120 (1895) 1306-1310.  
Jewell, L. E. Atrophys. J. 4 (1896) 324-342.  
Julius, Amsterdam Akad. Verhandl. I No. 1 (1892); Beibl. (1893) 34.  
Katz, G. J. Diss., Erlangen, 1898, 32 pp.; Beibl. 22 (1898) 774.  
Ketteler, E. Ann. Phys. n. F. 56 (1895) 56-77, 540-555.  
Kiesewetter, K., und G. Krüss. Ber. chem. Ges. 21 (1888) 2310-2320.  
Kirchhoff, G. Leipzig: Engelmann, 1898, Beibl. (1899) 140.  
Klaassen, Helen G. Phil. Mag. 44 (1897) 349-356.  
Königsberger, J. Ann. Phys. n. F. 61 (1897) 687-704.  
Krone, H. von. Eder's Jahrb. 10 (1896) 152-160; 11 (1897) 80-87.  
Krüger, F. Ztsch. Biol. 24 (1888) 47.  
Krüss, G. Ztsch. f. physikal. Chem. 2 (1888) 312-337; 15 (1895) 559-562.  
— — — u. L. F. Nilson. Ber. chem. Ges. 20 (1887) 2134-2171, 3067-3072; 21 (1888) 585-589.  
Kurlbaum, F. Ann. Phys. n. F. 61 (1897) 417-435.  
— — — Ann. Phys. n. F. 67 (1899) 846-858.  
Labatut. C.-R. 113 (1891) 126-129.  
Lachowitz, B. Ber. chem. Ges. 20 (1887) 735-743.  
Lampa, A. Sitzb. Wiener Akad. 100 II (1891) 730-739.  
Lapraik, W. J. prakt. Chem. (2) 47 (1893) 305-342.  
Lehmann, O. Ztsch. physikal. Chem. 14 (1894) 155-157.  
Lemoine, G. C.-R. 112 (1891) 936-939, 992-995, 1124-1127.  
— — — Ann. chim. phys. (7) 6 (1895) 433-540.  
Lenard, P. Ann. Phys. n. F. 56 (1895) 255-275.  
Liebermann, C. Ber. chem. Ges. 21 (1888) 2527.  
Liebisch, Th. Gött. Nachr. (1888) 202-210.  
Living, G. D. Cambridge Proc. 10 (1899) 40-44; Beibl. (1899) 782.  
— — — and J. Dewar. Phil. Mag. (5) 26 (1888) 286-291; Beibl. (1889) 16.  
— — — Proc. Roy. Soc. 46 (1889) 222-230; Beibl. (1889) 946.  
— — — Phil. Mag. (5) 39 (1895) 268-272; Beibl. (1896) 36, 193.

- Lupke, R.* Ztsch. phys. u. chem. Unterr. 6 (1893) 288-290; Beibl. (1894) 561.
- McClelland, J. H.* Proc. Roy. Soc. 60 (1896) 146-148.
- McGregor, J. G.* Trans. Roy. Soc. Canada. III (1891) 27-41; Beibl. (1893) 123.
- Magnanini, G.* Rend. Accad. Roma 14, 5a (1889) 908-912; Z. physikal. Chem. (1889) 427.
- —. Rend. Accad. Lincei 7 (1891) 356-363; Beibl. (1892) 427.
- —. Gazz. chim. Ital. 25 (1895) 373-379; Beibl. 20 (1896) 695.
- — e *Bentivoglio, T.* Rend. Accad. Roma (5) 2 (1893) 17-23; Beibl. (1893) 926.
- Maurer, J.* Repert. d. Phys. 25 (1889) 642-654; Beibl. (1890) 375.
- Merkelbach, W.* Ztsch. phys. u. chem. Unterr. 5 (1892) 253-254; Beibl. (1893) 564.
- Merritt, E.* Phys. Rev. 2 (1895) 424-442; Ann. Phys. n. F. 55 (1895) 49-64.
- Mewes, R.* Ann. Phys. n. F. 46 (1892) 171.
- —. Ztsch. f. komprom. u. fluss. Gase 1 (1897) 90-94; Beibl. (1898) 144.
- Monck, W. H. S.* Astron. and Astrophys. 12 (1893) 33-37; Beibl. (1893) 831.
- Moreau, G.* C.-R. 119 (1894) 327-329.
- —. C.-R. 119 (1894) 422-425.
- —. C.-R. 120 (1895) 258, 602-605.
- Muller, F. C. G.* Ztsch. phys. u. chem. Unterr. 8 (1895) 95-96; Beibl. (1895) 635.
- — — — u. *P. Kempf.* Pub. Astrophys. Observ. Potsdam 11 (1898) 211 pp.
- Müller-Erzbach, W.* Wiener Anzeiger (1889) 50-52, 327-339.
- —. Verh. deutsch. Naturf. u. Aerzte II 1 (1895) 70-72.
- —. Sitzb. Wiener Akad. 105 IIa (1896) 263-289.
- Nannes.* Oefvers. Akad. Stockholm. Forhandl. 53 (1896) 505-507.
- Nichols, E. L.* Phys. Rev. 2 (1895) 267.
- — — — and *Snow, B. W.* Phil. Mag. (5) 33 (1892) 379-381.
- Nordenskiöld, A. E.* Oefvers. Akad. Stockholm Forh. 44 (1887) 471-478.
- Novak, V., u. Sulc, O.* Ztsch. physikal. Chem. 19 (1896) 489-512.
- Oberbeck, A.* Naturwiss. Rundsch. 11 (1896) 265.
- Olzewski, K.* Sitzb. Wiener Akad. 95 II (1887) 257.
- — — —. Ann. Phys. n. F. 33 (1888) 570-575.
- — — —. Krakauer Anzeiger d. Akad. d. Wiss. (1889) 28.

- Patterson, T. L.* J. Soc. Chem. Industr. of Manchester (1890) 36.  
*Pauer, J.* Sitzb. med. Soc. Erlangen (1895) 7 pp.; Beibl. (1896) 606.  
 — Ann. phys. n. F. 61 (1897) 363-379.  
*Peddie, W.* Rept. Brit. Assoc. (1892) 661.  
*Pflüger, A.* Ann. Phys. n. F. 58 (1896) 670-673; Astrophys. J. 5 (1897) 68 Abs.  
*Pukering, E. C.* Annals Harvard Coll. Observ. 19 II (1893) 165-331.  
*Pitcher, E. R.* Amer. J. Sci. (3) 36 (1888) 332-336; Beibl. (1889) 218.  
*Planck, M.* Ann. Phys. n. F. 57 (1896) 1.  
*Plummer, W. E.* Nature 55 (1896) 235-236.  
*Potier, A.* C.-R. 114 (1892) 874-875.  
*Postma, O.* Diss., Amsterdam, 1895, 94 pp.; Beibl. (1898) 98.  
*Prytz, K., u. H. Holst.* Oevers k Danske Selsk. Forh. (1894) 12 pp.  
*Ramsay, W.* Ztsch. f. Kryst. u. Min. 13 (1887) 97-134; Beibl. (1888) 53.  
*Ranschoff, M.* Diss., Berlin, 1896, 32 pp.; Beibl. (1897) 737.  
*Rathenau, W.* Diss., Berlin, 1889, Beibl. (1894) 189.  
*Reinke, J.* Botan. Ztg. (1886) Nos. 9-14; Beibl. (1887) 709.  
*Report of the Committee on the Absorption Spectra of Pure Compounds.*  
 Rept. Brit. Assoc. (1889) 227, (1890) 339; (1891) 275.  
*Righi, A.* Nuovo Cim. 5 (1897) 466-470; Sitz. preuss. Akad. (1898) 600-603.  
 — C. R. 127 (1898) 216-219; Sitzb. preuss. Akad. (1898) 600-603.  
 — Rend. Accad. Roma 7 (1898) 41-46, 333-339; Nuov. Cim. 8 (1898) 102-109; 9 (1899) 295-312.  
 — Rend. Accad. Bologna, 1899, 27 pp.; Nuov. Cim. 10 (1899) 20-42.  
*Rigollot, H.* C.-R. 112 (1891) 38-40; Beibl. (1891) 280.  
*Rizzo, G. B.* Atti Accad. Torino 26 (1890-1891) 442-448; Beibl. (1891) 715.  
 — Atti Accad. Torino 28 (1893) 465-478; Beibl. (1893) 1059.  
 — Atti Accad. Torino 29 (1893-1894) 292-301; Beibl. (1894) 835.  
 — Nuov. Cim. 35 (1894) 132-136; Beibl. (1894) 836.  
*Rosenthal, H.* Ann. Phys. n. F. 68 (1899) 783-800.  
*Rubens, H., u. F. Ashkinass.* Ann. Phys. n. F. 64 (1898) 1584-601.  
 — u. A. Trowbridge. Ann. Phys. n. F. 60 (1897) 724-739.  
 — Verh. d. physikal. Ges. Berlin 15 (1896) 108-110; Beibl. (1897) 130.



- Paine, H. J. and Esposito, W. Rept. Brit. Assoc. 1886 576;  
 Beibl. 1887 422.  
 — — — and Esposito, W. J. Chem. News 53 1889 93; Beibl.  
 1890 290.  
 Sauer, P. C.-R. 103 1886 49-53.  
 — — — Ann. de Toulouse 1887 11 pp.; Beibl. 1888 194.  
 — — — C.-R. 118 1894 930-932, 1042-1043, 1144-1146.  
 Seitz, M. Ztsch. Pflüger's Archiv. 50 1891 574-586; Beibl. (1893)  
 421.  
 Szwed, G. C.-R. 128 1899 300-303.  
 Tunder, F. A. Johns Hopkins Univ. Cir. 18 1899 58-59.  
 Schuster, J. M. Lick Observat. Contrib. 3 (1893); Beibl. (1893)  
 650.  
 Schnellbach, K. Ztsch. phys. u. chem. Unterr. 2 1888 82-83; Beibl.  
 (1889) 681.  
 Schjerning, W. Diss. Beibl. (1887) 340.  
 Schmidt, G. C. Ztschr. physikal. Chem. 15 (1894) 56-65.  
 Schottlander, P. Ztsch. f. Instrum. 9 (1889) 98-101.  
 Schumann, V. Jahrb. f. Phot. (1893) 160-165; Beibl. (1893) 1030.  
 Schunck, C. A. Chem. News 51 (1885) 152.  
 — — — Proc. Roy. Soc. 63 (1898) 389-396.  
 Setchenow, T. Mem. Acad. St. Petersburg 34 (1886).  
 Smith, C. M. Proc. Roy. Soc. Edinburgh 17 (1889) 121-127.  
 Soret, J. L. Arch. de Genève (1887) 344-346; Beibl. (1888) 246.  
 — — — et A. A. Rilliet. C.-R. 110 (1890) 137-139.  
 Spring, W. Arch. de Genève (4) 2 (1896) 105-112.  
 — — — Arch. de Genève (4) 3 (1897) 437-464.  
 Stenger, Fr. Botan. Ztng. (1887) No. 8; Beibl. (1887) 709.  
 — — — Ann. Phys. n. F. 33 (1888) 577-586.  
 Stewart, O. M. Phys. Rev. 4 (1897) 433-456.  
 Thompson, C. M. Chem. News 55 (1887) 277.  
 Thompson, S. P. O. Rept. Brit. Assoc. (1898) 789-790.  
 Tichomirow, W. A. Russ. Ztsch. Pharm. 27 (1888) 545, 561; Jah-  
 resb. (1888) 442.  
 Trowbridge, J., and W. C. Sabine. Phil. Mag. (5) 26 (1888) 316; Jah-  
 resb. (1888) 443.  
 Udransky, L. von. Ztsch. f. physiol. Chem. 12 (1888) 355; Jahresb.  
 (1888) 1524-1534.  
 Very, F. W. Astrophys. J. 2 (1895) 237.  
 Vogel, H. C. Sitzb. Berliner Akad. (1896) 1219-1231; Beibl. (1897)  
 512.

- Vogel, H. W.* Sitzb. Berliner Akad. (1887) 715-718; Beibl. (1888) 48.  
*Voigt, W.* Ann. Phys. n. F. 31 (1887) 233-243.  
 ——— Ann. Phys. n. F. 35 (1888) 76-100.  
 ——— Gött. Nachr. (1896) 186-190; Beibl. (1896) 331.  
 ——— Gött. Nachr. (1896) 252-254, 560-562; Beibl. (1897) 1.  
 ——— Ann. Phys. n. F. 67 (1899) 366-387.  
 ——— Ann. Phys. n. F. 68 (1899) 598-603.  
*Wallach, O.* Gött. Nachr. (1896) Heft 4; Beibl. (1897) 633.  
*Walter, B.* Ann. Phys. n. F. 36 (1889) 502-518, 519-532.  
 ——— Jahresb. d. Hamburger wiss. Anst. 8 (1891) 5 pp.  
*Wilsing, J.* Astron. Nachr. 142 (1897) 241-251.  
*Wilson, W. E.* Astron. and Astrophys. (1892) 46-50.  
*Winkler, L. W.* Ztsch. physikal. Chem. 9 (1892) 171-176.  
*Wood, R. W.* Phil. Mag. (5) 41 (1896) 423-431, Beibl. (1896) 776.  
*Zenker, W.* Meteorol. Ztg. 5 (1888) 481-482; Beibl. (1888) 504.  
*Zsigmondy, R.* Dingler's pol. J. 289 (1893) 3 pp.; Beibl. (1896) 649.  
 ——— Ann. Phys. n. F. 57 (1895) 639-645.

## ACETIC ACID.

- Anbel, E. van.* J. de phys. (3) 4 (1895) 478-482; Beibl. (1896) 195.  
*Bruhl, J. W.* Ber. chem. Ges. 24 (1891) 656-658; Beibl. (1891) 555.  
 ——— Ber. chem. Ges. 25 (1892) 366-370, Beibl. (1892) 527.

## ACETYLENE.

- Lewes, V. B.* J. Chem. Soc. 69-70 (1896) 226-243; Beibl. (1896) 367.  
*Lichenthal, E.* Centralztg. f. Opt. u. Mech. 10 (1889) 50-53.  
*Moisson, H., et Ch. Mourcau.* C.-R. 122 (1896) 1240-1243.  
*Munby, A. E.* Chem. News 75 (1897) 260.  
*Perkin, W. H.* J. Chem. Soc. 67-68 (1895) 1-7.  
*Smithells, A.* J. Chem. Soc. 67-68 (1895) 1049-1062, 1149-1163;  
 Beibl. (1896) 367.  
*Violle, J.* Soc. franc. de phys. (1896) 39-40; Beibl. (1896) 275.

## ACTINOMETRY.

- Chwolson, O.* Repert. f. Meteorol. 15 (1892) 1-166; Beibl. (1893) 927.  
 ——— Mem. St. Petersburg Akad. 16 (1893) VII. 150 pp.; Beibl. (1893) 141-144.  
*Crova, A.* Ann. chim. phys. (6) 26 (1892) 286-288 Beibl. (1892) 609.  
 ——— C.-R. 122 (1896) 654-656.  
*Ebert, H.* Eder's Jahrb. f. Photogr. (1894) 4 pp.

## AETHYL.

*Brühl, J. W.* Ber. chem. Ges. 25 (1892) 1952-1956; Beibl. (1893) 823.

———. Liebig's Ann. 291 (1896) 137-146; Beibl. (1896) 871.

## AETZ.

*Baumhauer, H.* Sitzb. Berliner Akad. (1887) 863-878.

## ALBUMEN.

*Blyth, A. W.* Chem. News 80 (1899) 32; J. Chem. Soc. June 15, 1899.

*Ellinger, H. O. G.* J. prakt. Chem. 44 (1891) 256.

*Hartley, W. N.* J. Chem. Soc. 51 (1887) 58-61.

## ALCOHOL.

*Barbier, Ph., et L. Roux.* C.-R. 110 (1890) 1071-1074.

*Cole, A. D.* Phys. Rev. 4 (1897) 50-60, 415.—See Mohler, same vol. 153.

*Spring, W.* Ztsch. anorg. Chem. (1896) 253-261; Beibl. (1896) 535.

*Tolomei, G.* Riv. Sci. industr. 25 (1893) 71-72.

*Verschaffelt, J.* Bull. Acad. Belgique (1894) 49-84; Beibl. (1894) 833.

## ALIZARINE.

*Higgs, G.* Proc. Roy. Soc. 49 (1891) 345-346; Beibl. (1891) 518.

## ALKALIES.

*Dudley, W. L.* Nature 47 (1892) 175.

*Förster, F.* Ber. chem. Ges. 25 (1892) 2494-2518.

*Hartley, W. N.* J. Chem. Soc. Dec. 1, 1892; Beibl. (1893) 925.

*Kayser, H., und C. Runge.* Sitzb. Berliner Akad. (1890) 599-600; Jahresb. (1890) 390.

———, ———. Ann. Phys. n. F. 48 (1893) 150.

*Klatt, V., und Ph. Lenard.* Ann. Phys. n. F. 38 (1889) 90.

*Newth, G. S.* Nature 47 (1892) 55; Beibl. 17 (1893) 335.

*Rummell, L.* Proc. Roy. Soc. Victoria (1896) 260-263; (1897) 75-78.

*Snow, B. W.* Proc. Amer. Assoc. (1893) 79-80; Beibl. (1894) 912.

## ALUMINUM.

*Bidwell, S.* Nature 44 (1891) 565; Beibl. 16 (1891) 210.

*Glaserapp.* Photogr. Mittheil. 29 (1892) 111-113.

- Gramont, A. de.* C.-R. 127 (1898) 866-868.  
*Guillaume, Ch. Ed.* Nature 44 (1891) 540-541; Beibl. (1892) 278.  
*Hemsalech, G. A.* Phil. Mag. (5) 43 (1897) 289-291.  
*Humphreys, W. J.* Astrophys. J. 6 (1897) 169-232.  
*Hutchins, C. C.* Amer. J. Sci. (3) 43 (1892) 558-559; Beibl. (1892) 666.  
*Julus, V. A.* Natuurk. Verh. Akad. Amsterdam 26 (1888) 11 pp.; Beibl. (1889) 496-499.  
*Kayser, H., und C. Runge.* Ann. Phys. n. F. 48 (1893) 126.  
*Paterson, D.* J. Chem. Soc. 67 (1895) 66-68.  
*Porter, T. C.* Nature 45 (1891) 29; Beibl. (1892) 279.  
*Roscoe, H. E.* Proc. Roy. Soc. Inst. Gt. Brit., 3 May, 1889, 14 pp.  
*Runge, C.* Ann. Phys. n. F. 55 (1895) 44-48.  
*Soret, Ch., Arn. Borel, et E. Drumont.* Arch. de Genève (3) 3 (1897) 376-381; Beibl. (1897) 731.  
*Vernier, H.* Diss., Erlangen, 1896, 45 pp.; Beibl. (1897) 228.  
*Villon.* Photogr. Mittheil. 29 (1892) 209-212.

## ANTIMONY.

- Humphreys, W. J.* Astrophys. J. 6 (1897) 169-232.  
*Kayser, H., und C. Runge.* Sitzb. Berliner Akad. (1893) 20 pp.; Astrophys. J. (1895) 91, Abs.

## APPARATUS.

## (1) GENERAL AND MISCELLANEOUS.

- Blondel, A., et J. Rey.* C.-R. 126 (1898) 404-407.  
*Braham, Philip.* Rept. Brit. Assoc. (1889) 544.  
*Brodhun, E.* Ann. Phys. n. F. 34 (1897) 897-918. Leukoscop.  
 ——. Ztsch. f. Instrum. 17 (1897) 10-14; Beibl. (1897) 411.  
*Bruce, Miss Catherine.* Astrophys. J. 3 (1896) 150.  
*Cattell, J. McK.* Sci., n. s. 2 (1895) 13.  
*Cushman, H.* Sci., n. s. 2 (1895) 45; 3 (1896) 45.  
*Czapski, S.* Ztsch. f. Instrum. 9 (1889) 16-19.  
*Démichel.* Ztsch. phys. chem. Unterr. (1889) 90; Beibl. (1891) 105.  
*Finsterwalder, S.* Abh. Muenchener Akad. 17 (1891) 519-587; Beibl. (1892) 204-209.  
*Glazebrook, R. T.* Rept. Brit. Assoc. (1893) 688-689.  
*Hale, G. E., and F. L. O. Wadsworth.* Astrophys. J. (1896) 54-79.  
*Hallock, W.* Sci., n. s. 3 (1896) 45.

- Hamy, M.* C.-R. 125 (1897) 1092-1094.  
*Hartl, H.* Z. chem. Unterr. 9 (1896) 113-117; Beibl. (1896) 973.  
*Keeler, J. E.* Astrophys. J. 1 (1895) 353.  
*Kruss, H.* Ztsch. f. Instrum. 8 (1898) 388-392; Beibl. (1889) 79.  
 ——. Ztsch. f. Instrum. 15 (1895) 407.  
*Lockyer, J. N.* Nature 59 (1898) 371-374, 391-393.  
 ——. Z. phys. chem. Unterr. 12 (1899) 157-158; Beibl. (1899) 554.  
*Lommel, E.* Sitzb. Muenchener Akad. 22 (1892) 371-376.  
*Londé, A.* C.-R. 128 (1899) 817-819.  
*Lord, H. C.* Astrophys. J. 9 (1899) 191-203.  
 ——. Proc. Amer. Assoc. (1899) 69.  
*Love, E. F. J.* Phil. Mag. (5) 25 (1888) 1-6.  
*Lummer, O.* Verh. d. physikal. Ges. Berlin 14 (1896) 24-31.  
*Marcucci, S.* Nuovo Cim. 7 (1897) 325-331; Beibl. (1898) 568.  
*Mebius, C. A.* Oefvers. Akad. Stockholm Verh. 47 (1890) 29-43.  
*Moller, W.* Beibl. (1890) 1108.  
*Parry, J.* Industries 5 (1888) 11 pp. Practical Use.  
*Pellin, Ph., et A. Broca.* J. de phys. 8 (1899) 314-319.  
*Pulfrich, C.* Ztsch. f. Instrum. 14 (1894) 354-364; Astrophys. J. 1 (1895) 335-349.  
 ——. Ztsch. f. Instrum. 17 (1898) 239-241; Beibl. (1898) 34.  
 ——. Ztsch. f. Instrum. 18 (1898) 381-383; Beibl. (1899) 249, 774-775, Taf.  
*Righi, A.* Rend. Accad. Roma 5 (1889) 862-864.  
*Runge, C.* Phil. Mag. (5) 29 (1890) 462-466; Beibl. (1890) 781.  
*Rydberg, J. R.* Ztschr. f. Instrum. 16 (1896) 227-233.  
*Scheibner, W.* Astron. Nachr. 139 (1895) 193-200.  
*Scheiner, J.* Ztsch. f. Instr. 12 (1892) 365-374; Beibl. (1893) 1051.  
 ——. Ztsch. f. Instr. 14 (1894) 316-325; Beibl. (1894) 1045.  
*Schmidt, K. E. F.* Ann. Phys. n. F. 45 (1892) 377.  
*Schottländer, P.* Ztsch. f. Instrum. 9 (1889) 98; Beibl. (1889) 672.  
*Thierry, Maurice de.* C.-R. 120 (1895) 775-777.  
*Tschirch, A.* Naturwiss. Rundsch. 11 (1896) 240-242; Beibl. (1896) 535.  
*Vert, G.* C.-R. 123 (1896) 99-100.  
*Vogel, H. C.* Sitzb. Berliner Akad. (1898) 141-147; Beibl. (1898) 312.  
*Vogel, H. W.* Ber. chem. Ges. 21 (1888) 2029.  
 ——. Ztsch. f. Instrum. 1 (1888) 231; Beibl. (1890) 506.  
 ——. Verh. d. physikal. Ges. Berlin 14 (1896) 45-47.

Wadsworth, F. L. O. Phil Mag. (5) 38 (1894) 337-351; Beibl. (1895) 782.

— —. Phil Mag. (5) 37 (1894) 137-143; Beibl. (1895) 59.

Wildmann, F., und J. B. Messerschmidt. Ann. Phys. n. F. 34 (1888) 463.

Wulffing, E. A. N. Jahrb. f. Min., Beil. Bd. 12 (1898) 343-404; Beibl. (1899) 355-356.

— — —. N. Jahrb. f. Min., Beil. Bd. 12 (1898) 405-446; Beibl. (1899) 363.

## (2) ABSORPTION APPARATUS.

Cotton, A. Ann chim. phys. (8) 8 (1896) 347-432, Beibl. (1896) 882.

Leiss, C. N. Jahrb. f. Min. Geol. u. Palaont. 21 (1898) 69.

Olsewski, K. Krakauer Anzeiger d. Akad. d. Wiss. (1889) 28.

White, J. T. Chem News 58 (1888) 166.

## (3) ACTINOMETER.

Chwolson, O. Ann. Phys. n. F. 51 (1894) 396.

## (4) BOLOMETER.

Child, C. D., and O. M. Stewart. Phys. Rev. 4 (1897) 502-504.

Croza, A. Ann. chim. phys. (6) 29 (1892) 137-144; Beibl. (1893) 918.

Edelmann, M. Th. Beibl. (1894) 749.

Helmholtz, R. von. Verh. d. physikal. Ges. Berlin 7 (1888) 71-83; Beibl. (1889) 882.

Langle, S. P. Amer. J. Sci. (4) 5 (1898) 241-245; Beibl. (1898) 399.

— — —, C. A. Young, and E. C. Pickering. Annals Harvard Coll. Observ. 18 (1886) 301-324; Beibl. (1888) 337.

Lummer, O., und F. Kurlbaum. Ztsch. f. Instrum. 12 (1892) 81-89; Beibl. (1893) 746.

Reid, H. F. Amer. J. Sci. (3) 35 (1888) 160-166; Beibl. (1888) 337.

Sharp C. H., and W. K. Turnbull. Phys. Rev. 2 (1895) 1.

## (5) BURNERS.

Allihn, F. Ztsch. f. Glasinstrum.-Industr. 4 (1895) 121.

Drossbach, G. P. Chemiker Ztng 15 (1891) 328.

Du Bois, H. E. J. G. Ztsch. f. Instrum. 165-167; Beibl. (1893) 334.

Gumlich, E. Ztsch. f. Instrum. 16 (1896) 97-115.

- Haitinger, L.* Beibl. (1895) 425.  
*Meier, W.* Centralztng. f. Opt. u. Mech. 18 (1897) 33.  
*Meissner, K.* Chem. Centralbl. (4) 2 (1890) 730.  
*Munby, A. E.* Chem. News 75 (1897) 260.  
*Pulfrich, C.* Ztsch. f. Instrum. 18 (1898) 52.  
*Raddi, A.* Riv. Sci. 26 (1894) 98-116; Beibl. (1894) 997.  
*St. John, Ch. E.* Ann. Phys. n. F. 56 (1895) 433-450.  
*Steiger, E.* Ztsch. phys. chem. Unterr. 11 (1898) 32-33.  
*Teclu, N.* Chem. Centralbl. 63 (1892) 49.  
*Wehrsen, A.* Ztsch. f. Glasinstrum.-Industr. 5 (1896) 126.

## (6) COLORIMETERS.

- Albrecht, E.* Ztsch. f. Instrum. 12 (1892) 417; Beibl. (1893) 1062.  
*d'Arsonval.* Soc. franç. de phys. 3 (1890) 109; Beibl. (1891) 203.  
*Gallenkamp.* Chem. Centralbl. 63 (1892) 49.  
*Hoppe-Seyler, F.* Ztsch. f. Instrum. 16 (1892) 417.  
*Ives, F. E.* Trans. Roy. Scottish Soc. Arts 14 (1896) 136-151.  
 — — —. Photo. News 40 (1896) 500.  
*Kolbe, Br.* Ztsch. phys. u. chem. Unterr. (1895) 243.  
*Krüss, H.* Ztsch. f. Instrum. 8 (1888) 7-13, 53-63, 83-95 (Schluss).  
 — — —. Ztsch. physikal. Chem. 10 (1892) 165-182.  
 — — —. Ztsch. f. anorg. Chem. 5 (1893) 325-330; Beibl. (1894) 668.  
*McDonall, F. K.* Jour. B. A. A. 5 (1895) 517-519.  
*Mayer, A. A.* Phil. Mag. (5) 36 (1893) 153-175; Amer. J. Sci. (3) 31 (1893) 1-22.  
*Murphy, D. W.* Ann. Phys. n. F. 57 (1895) 593-603.  
*Nardroff, E. R. von.* Phys. Rev. 3 (1896) 306-309.  
*Nugues, A.* Chem. Centralbl. 63 (1892) 362.  
*Oosting, H. J.* Ztsch. f. phys. chem. Unterr. (1898) 132.  
*Rebenstorff, U.* Ann. Phys. n. F. 59 (1896) 227-232.  
*Schröder, H.* Centralztng. f. Opt. u. Mech. 10 (1889) 217-220.  
*Schuster, A.* Proc. Roy. Soc. 48 (1890) 140-149; Beibl. (1890) 1107.  
*Steinheil, R.* Ztsch. f. Instrum. 19 (1899) 177-183; Beibl. (1899) 770.  
*Stoney, G. J.* Phil. Mag. (5) 34 (1892) 415-428.

## (7) DIFFRACTION APPARATUS.

- Cornu, A.* Soc. franç. de phys. (1893) 1-2, 215-223, 223-232; Beibl. (1893) 195.  
 — — —. Rept. Brit. Assoc. (1894) 480-482.



## (8) DIRECT VISION SPECTROSCOPE.

*Konkoly, N. von.* Centralztng. f. Opt. u. Mech. 9 (1888) 1-3; Beibl. (1888) 657.

## (9) DISPERSION APPARATUS

*Gramont, A. de.* C.-R. 128 (1899) 1564-1568

*Guglielmo, G.* Rend. Accad. Lincei (4) 6 (1890) 195-199; Beibl. (1891) 105.

## (10) DYE-STUFF SPECTRUM PHOTOMETER.

*Patterson, T. L.* J. Soc. Chem. Industry, Manchester 9 (1890) 36; Beibl. (1892) 606.

## (11) ECHELON SPECTROSCOPE.

*Michelson, A. A.* Astrophys. J. 8 (1898) 37-47; see Mann in Sci. 8 (1898) 208-210.

## (12) ECLIPSE SPECTROSCOPES. (Look also under Telescopes.)

*Spec, E.* Bull. Acad. Roy. Belgique (3) 30 (1895) 274-276.

*Zenger, Ch. V.* C.-R. 121 (1895) 406-408; Bull. Soc. Belg. d'Astron. 1 (1896) 8-12.

## (13) ELECTRIC APPARATUS.

*Barns, C.* Phys. Rev. 4 (1897) 400-404.

*Rose, J. Ch.* Phil. Mag. (5) 43 (1897) 55-69, 260.

*Buti, G.* Atti Accad. Nuovi Lin. 44 (1891) 170-172; Beibl. (1893) 339.

*Dennis, L. M.* J. Amer. Chem. Soc. 20 (1898) 1; Beibl. (1898) 218.

*Des Coudres, Th.* Ann. Phys. n. F. 62 (1897) 134-144.

*Fuchs, P.* Ztsch. f. Glasinstrum.-Industrie 7 (1897) 4-6; Beibl. (1898) 218.

*Gouy, C.-R.* 121 (1895) 201-202.

*Hull, G. F.* Astrophys. J. 6 (1897) 141-144.

*Lagrange, Ch.* C.-R. 120 (1895) 1333.

*Martini, T.* Riv. Sci. Industr. 23 (1891) 135-136; Beibl. (1891) 713.

*Perry, J.* Proc. Roy. Soc. 51 (1891) 455-463.

*Rowland, H. A.* Johns Hopkins Univ. Cir. 2 (1892) 104-105.

*Rutherford, E.* Proc. Roy. Soc. 60 (1896) 184-186.

*Thompson, S. P.* Nature 56 (1897) 342-343.

*Wadsworth, F. L. O.* Amer. J. Sci. (3) 48 (1894) 496-501.

*Warren, H. N.* Chem. News 65 (1892) 87.

(14) FLUOROSCOPES.

*Edison, T. N.* Electrician 36 (1896) 834-835.

*Martens, F. F.* Ztsch. f. Instrum. 18 (1898) 252-253; Beibl. (1898) 777.

*Trowbridge, C. C.* New York Acad. Trans. 11 (1898) 31.

(15) GAS SPECTROSCOPES.

*Berthelot.* Ann. chim. phys. (7) 11 (1897) 43-77; C.-R. 124 (1897) 525-528.

*Lunge, G.* Ber. chem. Ges. 24 (1891) 3948-3950.

(16) GRATINGS.

*Ames, J. S.* Phil. Mag. (5) 27 (1889) 369-384; Beibl. (1888) 673.

*Bruere, Miss A. H.* Phys. Rev. 3 (1896) 301-305; Beibl. (1896) 653

*Hadden, D. E.* Pop. Astron. 3 (1895) 84-86.

*Haga, H.* Ann. Phys. n. F. 57 (1896) 389-393.

*Jewell, L. E.* Astron. and Astrophys. 13 (1894) 44-48; Beibl. (1894) 749.

*Larmor, J.* Proc. Lond. Math. Soc. 24 (1892-1893) 161.

*Mitchell, S. A.* Astrophys. J. 8 (1898) 102-112; Johns Hopkins Univ. Cir. (1898) 56.

—— — —. Astrophys. J. 10 (1899) 29-39; Beibl. (1899) 773.

*Newall, H. F.* Mon. Not. 52 (1892) 509-512; Beibl. (1893) 129.

*Olsen, H.* Ztsch. f. Instrum. 18 (1898) 280-283; Beibl. (1899) 557.

*Olsson,* . Oefvers. Vet. Akad. Stockholm 55 (1898) 5-33.

*Poor, Ch. L., and S. A. Mitchell.* Astrophys. J. (1898) 157-163; Johns Hopkins Univ. Cir. (1898) 61-62.

—— — —. Astrophys. J. 8 (1898) 235-236.

*Rayleigh, Lord.* Nature 54 (1896) 332-333.

*Righi, A.* Atti Ist. Ven. (6) 5 (1887) 60 pp.; Beibl. (1887) 539-543.

*Rowland, H. A.* Astron. and Astrophys. 12 (1893) 129-147; Beibl. (1893) 838; Phil. Mag. (5) 35 (1893) 397-419.

*Rydberg, J. R.* Phil. Mag. (5) 35 (1893) 190-199; Bih. Svensk. Akad. Handl. 18 (1893) No. 9; Beibl. (1893) 840.

*Thompson, S. P.* Chem. News 59 (1889) 70; Beibl. (1890) 624.

*Wadsworth, F. L. O.* Astrophys. J. 2 (1895) 370-382.

—— — — —. Astrophys. J. 3 (1896) 47-62.

## (17) HARMONIC ANALYSER.

*Michelson, A. A., and W. W. Stratton* Phil. Mag. (5) 45 (1898) 85-91; Amer J Sci (4) 5 (1898) 14

## (18) HEAT SPECTRA APPARATUS.

*Carralio, E.* Soc. franç. de phys. (3) 2 (1893) 27-36; Beibl. (1893) 562.

*Crova, A.* C.-R. 114 (1892) 941-943

*Hamy, M.* Observat. 19 (1896) 155-156.

*Hartley, W. N.* Proc. Roy. Soc. 54 (1892-1893) 5-7; Beibl. (1893) 1055.

— — — Rept. Brit. Assoc. (1894) 610-611.

*Le Châtelier.* Soc. franç. de phys. (1892) 2.

*Levy, L.* Der Mechaniker 3 (1895) 73-74.

*Lussana, S.* Riv. Sci. industr. 29 (1897) 283-287; Beibl. (1898) 665.

*Mesure et Nouel* Dingler's pol. J. 272 (1889) 361-362; Beibl. (1889) 496.

*Meutznier, P.* Ztsch. f. phys. chem. Unterr. 5 (1892) 306; Beibl. (1892) 738

*Wood, R. W.* Ann. Phys. n. F. 59 (1896) 238-251.

## (19) INTERFERENCE APPARATUS.

*Barns, C.* Amer. J. Sci. (4) 3 (1897) 107-117.

*Borgesius, A. H.* Versl. Akad. Amsterdam 3 (1895) 99-104; Beibl. (1895) 168.

*Croft, W. B.* Rept. Brit. Assoc. (1893) 685-686.

*Crova, A.* C.-R. 116 (1893) 672-674; Beibl. (1894) 193.

*Ebert, H.* Ann. Phys. n. F. 34 (1888) 39.

*Fabry, Ch., et A. Perot.* C.-R. 126 (1898) 331-335, 407; Beibl. (1889) 29.

*Faidiga, A.* Der Mechaniker 3 (1895) 193-196.

*Gouy* C.-R. 120 (1895) 1039-1041

*Hallwachs, W.* Ann. Phys. n. F. 55 (1895) 282-287, 412.

*Hamy, M.* C.-R. 126 (1898) 1772-1775.

*Hull, G. F.* Phys. Rev. 5 (1897) 231-247.

*Leiss, C.* Neues Jahrb. f. Min. Geol. u. Paleontol. 2 I (1898) 72-74.

*Levy, L.* Der Mechaniker 7 (1899) 111-113; Beibl. (1899) 773.

*Mach, E.* Wiener Anzeiger (1891) 223-224.

*Mach, L.* Sitzb. Wiener Akad. 101 II (1892) 5-10; 102 IIa (1893) 1035-1056.

- Mach, L.* (*Cont'd*). Sitzb. Wiener Akad. 107 II (1898) 851-859.  
*Michelson, A. A.* Soc. franç. de phys. (1893) 3-5. See *Strehl*, below.  
*Perot, A., et Ch. Fabry.* C.-R. 126 (1898) 34-36.  
 ———, ———. J. de phys. 7 (1898) 650-660.  
*Preston, Th.* Nature 59 (1898) 605.  
*Pringsheim, E.* Verhandl. d. physikal. Ges. Berlin 17 (1898) 152-156.  
*Pulfrich, C.* Ztsch. f. Instrum. 18 (1898) 261-267; Beibl. (1899) 559.  
*Sirks, F. L.* Beibl. (1894) 458.  
*Tutton, A. E.* Proc. Roy. Soc. 63 (1898) 208-211; Beibl. (1899) 342, 422.  
 ———. Ztsch. f. Kryst. u. Min. 31 (1899) 383-384.  
*Wadsworth, F. L. O.* Phys. Rev. 4 (1897) 480-497; Beibl. (1898) 623.  
 ———. Phil. Mag. (5) 43 (1898) 317-343; Beibl. (1898) 555.  
*Wiedeburg, O.* Ann. phys. n. F. 59 (1896) 497-522.  
*Zehnder, L.* Ztsch. f. Instrum. 11 (1891) 275-285; Beibl. (1892) 212.  
*Zenker, W.* Ztsch. f. Instrum. 7 (1887) 1-7; Beibl. (1887) 442.

## (20) LAMPS.

- Auer'sches.* Dingler's pol. J. 280 (1891) 168; Beibl. (1891) 667.  
*Ayrton, W. E., and E. A. Medley.* Phil. Mag. (5) 39 (1895) 389-422.  
*Bay* C.-R. 113 (1891) 298-300.  
*Basala, J.* Grunert's Archiv. (2) 11 (1892) 113-131; Beibl. (1893) 120.  
*Boehm's Faeden.* Dingler's pol. J. 289 (1893) 216.  
*Buguet, A.* J. de phys. 3 (1888) 257-259; Beibl. (1888) 855.  
*Clifford, H. E.* Technol. Quar. 3 (1890) 167-169; Beibl. (1891) 34.  
*Crova, A.* C.-R. 119 (1894) 627-630.  
*Gumlich, E.* Ztsch. f. Instrum. 17 (1897) 161-165.  
*Hamy, M.* C.-R. 124 (1897) 749-752.  
*Harcourt, A. Vernon.* Rept. Brit. Assoc. (1895) 582; Beibl. (1896) 26.  
*Hoffmann, M. W.* Ann. Phys. n. F. 60 (1897) 642-652.  
*Ives, F. E.* Dingler's pol. J. 276 (1890) 322.  
*Kruss, H.* Beibl. (1889) 215.  
*Leiss, C.* Ztsch. f. Instrum. 18 (1898) 209-213.  
*Liebenthal, E.* Centralztng. f. Opt. u. Mech. 9 (1888) 266-270, 278-279.  
 ———. Centralztng. f. Opt. u. Mech. 10 (1889) 37-42, 50-53; Beibl. (1889) 676.

- Liebenthal, E.* Ztsch. f. Instrum. 15 (1895) 157-171; Beibl. (1895) 692.
- . Ztsch. f. Instrum. 19 (1899) 193 206, 225-240.
- Lupke, R.* Ztsch. phys. chem. Unterr. 6 (1893) 288-290; Beibl. (1894) 561.
- Lützen, G.* Centralztng. f. Opt. u. Mech. 16 (1894) 15-16.
- Moll, A.* Photogr. Mittheil. 26 (1889) 55 59; Beibl. (1889) 809.
- Nicholls, E. L.* Amer. J. Sci. (3) 44 (1892) 277-286.
- . Phys. Rev. 2 (1895) 260-276; Beibl. (1895) 783.
- Onnes, H. H.* Comm. Phys. Lab. Leiden, No. 25, 1897, 10 pp.
- Onnes, H. K.* Arch. néerland. (2) 1 (1898) 405-410.
- Paquelin, C.-R.* 113 (1891) 384-385.
- Poland, L. N. P.* Dingler's pol. J. 278 (1890) 46.
- Pringsheim, E.* Ann. Phys. n. F. 45 (1892) 426.
- Prowse, G. R.* Proc. and Trans. Roy. Soc. Canada 9 (1891) 55-58.
- Salomons, D.* Chem. News 72 (1895) 116.
- Schiefferdecker, P.* Centralztng. f. Opt. u. Mech. 12 (1891) 73-75.
- Spaulden, E.* Photogr. Mittheil. 30 (1893) 38-40.
- . Photogr. Mittheil. 32 (1895) 6-11.
- Staepfer, D.* Bull. Soc. Sci. et Industr. Marseille, 1892 12 pp.; Beibl. (1893) 445.
- Vogel, E., jun.* Photogr. Mittheil. 26 (1890) 135-136.
- Vogel, H. W.* Photogr. Mittheil. 29 (1892) 302-304; Beibl. (1893) 925.
- . Photogr. Mittheil. 29 (1893) 383-385; Beibl. (1893) 748.
- Warren, H. N.* Chem. News 65 (1892) 289-290.
- Weber, H. S.* Phys. Rev. 2 (1895) 112, 197.
- Wiedemann, E.* Jahrb. f. Photogr. 5 (1891) 587-591; Beibl. (1891) 281.
- Wild, H.* Bull. Acad. St. Petersburg 12 (1887) 755-791; Beibl. 12 (1888) 669.

## (21) MICROMETERS.

- Barnard, F. E.* Mon. Not. 56 (1896) 163-172.
- Bigourdan, G.* C. R. 123 (1896) 1048-1050; Beibl. (1897) 512.
- Boys, C. V.* Phil. Trans. Lond. 180 (1889) 159-186; Beibl. (1890) 507.
- Calker, F. J. van.* Ztsch. f. Krystallogr. 12 (1887) 55.
- Engelmann, W.* Arch. néerland. 23 (1888) 82-92; Beibl. (1889) 216.
- Fulius, W. H.* Beibl. (1896) 27.

## (22) MINERALOGICAL SPECTROSCOPES.

*Leiss, C.* Neues Jahrb. f. Min. Geol. u. Paleontol. 2 I (1898) 70.

*Wallerant, F.* C.-R. 124 (1897) 315-317; Beibl. (1897) 509.

*Wülfing, E. A.* Min. u. Petrog. Mittheil. 15 (1895) 49-76; Beibl. (1898) 103.

## (23) PHOSPHOROSCOPE.

*Lenard, Ph.* Ann. Phys. n. F. 46 (1892) 637.

## (24) APPARATUS FOR PHOTOGRAPHING SPECTRA.

*Abney, W. de W.* Proc. Roy. Soc. 60 (1896) 13-15.

*Angstrom, K.* Phys. Rev. 3 (1895) 137-141 from Hosala Trans., April 10, 1895.

*Archenhold, F. S.* Ztsch. f. Instrum. 15 (1895) 406.

*Ballard, E. G.* J. Chem. Industr. 9 (1890) 469.

*Barnard, E. E.* Astrophys. J. 2 (1895) 351-353.

*Charier.* Vierteljahrss. d. astron. Ges. 31 (1897) 250, 255, 266-278.

*Cornu, A.* C.-R. 110 (1890) 551-557.

*Ebert, H.* Jahrb. f. Photogr. u. Reproduct. (1896) 126-128.

*Eder, J. M.* Monatsh. f. Chem. 7 (1886) 429.

*Fery, Ch.* C.-R. 126 (1898) 333-335.

*Gothard, E. von.* Jahrb. f. Photogr. u. Reprod. (1888) 7 pp.; Beibl. (1888) 249.

*Harting, H.* Ztsch. f. Instr. 19 (1889) 269-272.

*Hartmann, J.* Ztsch. f. Instr. 19 (1899) 97-104.

*Huggins, Sir William.* Astrophys. J. 5 (1897) 8-10.

*Hutchins, C. C.* Amer. J. Sci. (3) 33 (1887) 58-59; Beibl. (1888) 46.

*Izarn,* . C.-R. 116 (1893) 572-574.

——. Photo Times 39 (1895) 827-828.

*Janssen, J.* C.-R. 116 (1893) 456-458.

*Joly, J.* Proc. Roy. Soc. Dublin n. s. 7 (1892) 196-201.

*Jones, C.* Brit. Jour. Photogr. 42 (1895) 794.

*Keeler, J. E.* Astrophys. J. 1 (1895) 350-351.

*Konkoly, N. von.* Centralztng. f. Opt. u. Mech. 8 (1887) 241; Beibl. (1888) 45.

*Leiss, C.* Sitzb. Berliner Akad. (1899) 42-47, 178-179.

*Liveing, G. D.* Cambridge Proc. 9 (1896) 141-142.

*Lord, H. C.* Astrophys. J. (1897) 50-54, 87-90; Beibl. (1897) 335.

*Lunt, J.* Nature 54 (1896) 84-86.

- Prinz, W.* Ciel et Terre 6 (1895) 121-130, 153-163.  
*Rayleigh, Lord.* Phil. Mag. (5) 43 (1897) 282-285.  
*Schäiner, J.* Astron. Nachr. 124 (1890) 279-282; Beibl. (1891) 207.  
*Schumann, V.* Astrophys. J. 3 (1896) 220-226, 387-394; 4 (1896) 144-155.  
*Schutt, F.* Ann. Phys. n. F. 57 (1896) 533-554.  
*Thuing, Ch. B.* Amer. J. Sci. (3) 42 (1891) 388-390; Beibl. (1892) 364.  
*Todd, D. P.* Astrophys. J. 5 (1897) 318-324.  
 — — —. Astrophys. J. 8 (1898) 253.  
*Turner, H. H.* Jour. R. A. A. 5 (1895) 400.  
*Wadsworth, F. L. O.* Astrophys. J. 1 (1895) 252-260.  
*Wilsing, J.* Astron. Nachr. 142 (1897) 241-251.  
*Wolf, M.* Astron. Nachr. (1887) 79-80; Beibl. (1888) 657.  
 — — —. Ztsch. f. Instrum. 14 (1895) 203-214.  
 — — —. Nature 55 (1897) 582-586.

## (25) PHOTOMETERS

- Adney, W. E., and J. Trison.* Phil. Mag. (5) 46 (1898) 223-227.  
*Albrecht, E.* Beibl. (1893) 562. Hueffner's.  
*d'Ansonval.* Soc. franç. de phys. 1 (1890) 109; Beibl. (1891) 204.  
*Battmann, H.* Astron. Nachr. 120 (1889) 337-416.  
*Boulouch, R.* C. R. 111 (1890) 642-644.  
*Brace, D. B.* Proc. Amer. Assoc. (1899) 115.  
*Brodhun, E.* Verhandl. d. physikal. Ges. Berlin 9 (1890) 33-35.  
*Bruecke, E.* Ztsch. f. Instrum. 10 (1890) 11-16; Beibl. (1890) 506.  
*Burch, G. J.* Phil. Mag. (5) 43 (1897) 256-259.  
*Capps, E. V.* Proc. Amer. Assoc. 48 (1899) 131.  
*Ceraski, W.* Beibl. (1889) 881.  
*Charlier, C. V. L.* Beibl. (1894) 99, 565.  
*Charlier, L.* Beibl. (1889) 950-951.  
*Chvolson, O.* Mem. St. Petersburg Akad. 16 (1893) VII, 150 pp.; Beibl. (1894) 190-192.  
*Czapski, S.* Ztsch. f. Instrum. 12 (1892) 161-162.  
*Ebert, H.* Ann. Phys. n. F. 38 (1889) 489-494.  
*Erhard, Th.* Beibl. (1890) 372.  
*Flamache, A.* Bull. Soc. Belge d'Astron. 1 (1896) 204-207.  
*Foussereau, G.* J. de phys. (3) 4 (1895) 169-178, 260-262; Beibl. (1895) 627.  
*Frisch, G.* Beibl. (1890) 273.  
*Gothard, E. von.* Beibl. (1888) 46.



- Grosse, W.* Beibl. (1887) 775; (1888) 784.
- Hale, G. E.* Astron. and Astrophys. 12 (1893) 241-257; Beibl. (1894) 89.
- Hallwachs, W.* Ann. Phys. n. F. 21 (1897) 730.
- Hänsch, sen.* Verh. d. Ges. deutsch. Naturf. u. Aerzte (1893) 23.
- Hebert, A., u. G. Reynaud.* Chem. Centralbl. (1898) 1265.
- Heen, P. de.* Bull. Acad. Belgique (3) 32 (1896) 75-82.
- Henry, Ch.* C.-R. 115 (1892) 505-507.
- . C.-R. 128 (1899) 941-944; Beibl. (1899) 639.
- Hesehus, N.* Beibl. (1893) 649.
- Houston and Kenelly.* Beibl. (1895) 692.
- Huefner, G.* Ztsch. phys. Chem 3 (1889) 562-571; Beibl. (1889) 882.
- Hutchins, C. C.* Amer. J. Sci. (3) 34 (1887) 466; Beibl. (1888) 471.
- Jammann, G.* Sitzb. Wiener Akad. 97 (1888) 64-68.
- Joly, J.* Phil. Mag. (5) 26 (1888) 26-28.
- . Nature 48 (1893) 269.
- Kolbe, B.* Beibl. (1887) 535-536.
- König, A.* Ann. Phys. n. F. 46 (1892) 527; 53 (1894) 785-792; Chem. News 72 (1895) 236.
- Krüss, H.* Ztsch. f. Instrum. 7 (1887) 215-218; Beibl. (1887) 700.
- . Beibl. (1888) 192.
- . Beibl. (1889) 163.
- . Beibl. (1889) 676.
- . Beibl. (1894) 1045.
- . Beibl. (1895) 274, 772, 773; (1898) 839.
- Lehmann, E. und W.* Ann. Phys. n. F. 49 (1893) 672.
- Leiss, C.* Beibl. (1897) 971; (1898) 221.
- Lepinay, J. Mace de.* Ann. Fac. de Marseille, 1895, 14 pp.; Beibl. (1896) 273.
- Liebenthal, E.* Beibl. (1889) 674.
- Lorentzen, G.* Astron. Nachr. 131 (1892) 217-238; 135 (1894) 353-366.
- Lummer, O.* Ann. Phys. n. F. 46 (1892) 337.
- . Ann. Phys. n. F. 48 (1893) 7.
- und *E. Brodhun.* Beibl. (1889) 674.
- , ———. Beibl. (1894) 80.
- Melander, G.* Beibl. (1899) 178.
- Mendenhall, T. C.* Nature 50 (1894) 584-587.
- Meslin, G.* J. de phys. 5 (1896) 202-204.
- Mesnard, E.* Soc. franç. de phys. (1893) 172-175; Beibl. (1894) 559.
- Nebel, B.* Beibl. (1889) 673.

- Nichols, E. L.* Beibl. (1891) 278.  
 ———. Phys. Rev. 2 (1895) 138-141; Beibl. (1895) 241.  
*Perot, A., et Fabry, C.* C.-R. 123 (1896) 990-993.  
 ———. C.-R. 126 (1898) 1779-1782.  
*Pickering, E. C.* Astrophys. J. (1895) 89-96; Beibl. (1896) 197.  
*Preece, W. H., and A. P. Trotter.* Ztsch. f. Instr. (1896) 157-159;  
 Beibl. (1897) 336.  
*Pulfrich, C.* Ztsch. f. Instrum. 13 (1893) 365-380.  
*Rayleigh, Lord.* Nature 41 (1890) 197.  
*Reinke, J.* Ann. Phys. u. F. 27 (1886) 440.  
*Seguy, G.* Ztsch. f. Instrum. 13 (1893) 430; Beibl. (1894) 189; (1895)  
 629.  
*Sharp, C. H.* Phys. Rev. 3 (1896) 458-470; Beibl. (1896) 772.  
*Simon, H. Th.* Jahrb. f. Photogr. 12 (1898) 10-14; Beibl. (1898)  
 838.  
*Simonsen, E. A.* Diss. Kiel, 1892, 36 pp.  
*Spitta, E. J.* Proc. Roy. Soc. 47 (1890) 15-18; Beibl. (1890) 5re.  
*Spurge, J. B.* Proc. Phys. Soc. Lond. 69 (1894) 72; Beibl. (1894)  
 172.  
*Strecker, K.* Beibl. (1887) 775.  
*Strehl, K.* Centralztng. f. Opt. u. Mech. 15 (1894) 145.  
*Tatnall, R. R.* Astron. and Astrophys. 11 (1892) 932-933; Beibl.  
 (1893) 824.  
*Thiele, E.* Ztsch. f. physikal. Chem. 16 (1895) 147-155.  
*Tissandier, G.* La Nature 18 (1890) 219; Beibl. (1890) 1094.  
*Trotter, A. P.* Proc. Phys. Soc. Lond. 12 (1893) 82-88; Beibl. (1894)  
 667.  
*Trowbridge, J.* Physikal. Rev. 2 (1892) 473-476.  
*Ulsch, K.* Chem. Centralbl. (4) 2 (1890) 569.  
*Varley, F. H.* Rept. Brit. Assoc. (1890) 759-760.  
*Violle, J.* Séances Soc. franç. de phys. (1895) 165; (1896) 39-40;  
 C.-R. 122 (1896) 97.  
*Weber, H. F.* Beibl. (1888) 338.  
*Weber, L.* Beibl. (1891) 350.  
*Whitman, F. P.* Proc. Amer. Assoc. (1895) 56; Phys. Rev. 3 (1895-  
 1896) 241-249.

## (26) PRISMS.

- Abbot, C. G., and F. E. Foule.* Amer. J. Sci. (4) 2 (1896) 255-257  
*Braun, C.* Ber. aus Ungarn 3 (1885) 197-200; Beibl. (1888) 335.

- Cinelli, M.* Nuovo Cim. (4) 1 (1895) 141-155; Beibl. (1895) 788.
- Dubois, H. E. J. G.* Handel. derde Nederl. Congres (1891) 105-107.
- Feussner.* Sitzb. Ges. Marburg (1888).
- Fowle, F. E.* Amer. J. Sci. (4) 2 (1896) 255-258.
- Halle, G.* Ztsch. f. Instrum. 17 (1897) 138-139; Beibl. (1897) 628.
- Hartley, W. N.* Nature 44 (1891) 275; Beibl. (1891) 770.
- Herschel, A. S.* Rept. Brit. Assoc. (1885) 942-944; Beibl. (1888) 336.
- Jacoby, H.* Observat. 19 (1896) 205-206.
- Jadanza.* Atti Accad. Torino 26 (1890-1891) 459-466; Beibl. (1892) 200.
- Knorre, V.* Sternwarte zu Berlin, Heft 6, 1892, pp. 1-12.
- Krüss, H.* Ztsch. f. Instrum. 10 (1890) 97-100; Beibl. (1890) 505.
- Leiss, C.* Sitzb. Berliner Akad. 40 (1897) 901-904; Beibl. (1898) 104.
- . Ztsch. f. Instrum. 18 (1898) 325-331; Beibl. (1898) 249.
- Lommel, E. von.* Sitzb. Muenchener Akad. 28 (1898) 111-116; Beibl. (1898) 404.
- Madan, H. G.* Nature 41 (1890) 52-53.
- Maunder, E. W.* Observat. 19 (1896) 84-86.
- Melander, G.* Oefvers. Finska Vet. Forhandl. 40 (1898) 4 pp.
- Meslin, G.* C.-R. 120 (1895) 261-263.
- Müller, F. C. G.* Ztsch. phys. chem. Unterr. 3 (1890) 247-248.
- Newall, H. F.* Proc. Phil. Soc. Cambridge 8 (1894) 138-141; Beibl. (1895) 328.
- Nichols, E. L.* Phys. Rev. 2 (1895) 260.
- Pickering, E. C.* Astron. and Astrophys. (1892) 199-203.
- Pulfrich, C.* Ztsch. f. Krystallogr. 30 (1898) 568-586; Beibl. (1899) 354.
- Shea, D.* Ann. Phys. n. F. 47 (1892) 177.
- Straubel, R.* Ann. Phys. n. F. 66 (1898) 346-349.
- Thompson, S. P.* Phil. Mag. (5) 31 (1891) 120-123; Beibl. (1891) 512.
- Tutton, A. E.* Proc. Roy. Soc. 54 (1894) 111-113.
- Wadsworth, F. L. O.* Astrophys. J. (1895) 232-247; Beibl. (1896) 196.
- ———. Astrophys. J. 2 (1895) 264-282.
- ———. Astrophys. J. 4 (1896) 274-277.
- ———. Astrophys. J. 5 (1897) 149.
- Wanach, B.* Ztsch. f. Instrum. 19 (1899) 161-177.
- Weinschenk, E.* Ztsch. f. Krystallogr. 24 (1895) 81-84; Beibl. (1896) 43.
- Wilsing, J.* Ztsch. f. Math. u. Phys. 40 (1895) 353-362.

## (27) REFRACTOMETERS.

- Biel, F.* Beibl. (1891) 278.  
*Cesaro, G.* Bull. Acad. Belgique (3) 22 (1892) 503-512.  
*Dongier, R.* C.-R. 122 (1896) 306-309.  
*Eijkmann, J. F.* Rec. des Trav. des Pays-Bas 12 (1893) 268-286.  
*Fery, C.* C.-R. 113 (1891) 1028-1030; Beibl. (1892) 273.  
 ——. Bull. Soc. chim. Paris (3) 9 (1893) 244-248.  
*Fichtbauer* Verh. deutsch. Naturf. u. Aerzte 65 (1893) 19-22.  
*Hallwachs, W.* Ann. Phys. n. F. 50 (1893) 577.  
 ——. Ann. Phys. 68 (1899) 1-45.  
*Hasselberg, P.* Öfvers. Vet. Akad. Forh. Stockholm 49 (1892) 441-449; Beibl. (1893) 915.  
*Jean, F.* Ann. Phys. Beibl. (1891) 33.  
*Junz* Centralztg. f. Opt. u. Mech. (1893) 2-3.  
*Kolbe, B.* Ztsch. f. phys. u. chem. Unterr. 9 (1896) 20-24.  
*Leiss, C.* Der Mechaniker 7 (1898) 75-76.  
 ——. Ztsch. f. Instrum. 19 (1899) 65-74; Beibl. (1899) 767.  
 ——. Ztsch. f. Min. Krystallogr. 30 (1898) 357-372; Beibl. (1899) 176.  
*Lommel, E. von.* Beibl. (1894) 674, 1001.  
*Moses, A. J., und Weinschenk, E.* Ztsch. f. Kryst. u. Min. 26 (1896) 150-156.  
*Pjuhl, F.* Ztsch. f. phys. u. chem. Unterr. 11 (1898) 159-162.  
*Pulfrich, C.* Ztsch. f. Instrum. 15 (1895) 389-394; Beibl. (1896) 191.  
 ——. Ztsch. f. Instrum. 18 (1898) 107-116; Beibl. (1898) 661.  
*Ruoss, H.* Ann. Phys. n. F. (1893) 531.  
*Sella, A.* Rend. Accad. Roma 7 (1891) 300-308, Beibl. (1892) 423.  
*Silow, P.* Ztsch. f. phys. u. chem. Unterr. 6 (1896) 280-282.  
*Verschaffelt, J.* Bull. Acad. Belg. (3) 27 (1894) 49-68; Beibl. (1894) 746.  
*Wallerant, F.* Bull. Soc. min. Paris 22 (1899) 69-71.  
*Wolz, M.* Beibl. (1891) 103.

## (28) SACCHARIMETERS.

- Duboscq, Th., u. A.* Beibl. (1887) 47.  
*Glan, P.* Chemikerztg. 14 (1890) 1306; Jahresb. (1890) 2607.  
*Laurent, L.* C.-R. 105 (1887) 409; Jahresb. (1887) 360.

## (29) SCREENS.

- Deville, E.* Trans. Roy. Soc. Canada (2) 1, III (1895) 29-61; Beibl. (1897) 418.

*Henry, Ch.* C.-R. 123 (1896) 400.

*Hurion, A.* J. de phys. (2) 9 (1890) 55-57.

*Trowbridge, C. C.* Annals New York Acad. Sci. II (1898) 39-45.

*Villard, P.* Éclairage électrique 16 (1898) 313-314.

### (30) SENSITOMETERS.

*Krusa, O.* Jahrb. f. Photogr. (1893) 189-191; Beibl. (1893) 1070.

*Vogel, H. W.* Jahrb. f. Photogr. 10 (1896) 230-236; Beibl. (1896) 980.

### (31) SLITS.

*Crookes, W.* Chem. News 71 (1895) 175; Beibl. (1895) 302.

*Leiss, C.* Ztsch. f. Instrum. 18 (1898) 116; Beibl. (1898) 664.

*Straubel, R.* Ann. Phys. n. F. 66 (1898) 350-352.

*Wadsworth, F. L. O.* Amer. J. Sci. (3) 48 (1894) 19-21; Beibl. (1894) 996.

*Walker, J.* Phil. Mag. (5) 46 (1898) 472-478, 553-557.

### (32) SPECTROPOLARIMETER.

*Lommel, A. von.* Verh. deutsch. Naturf. u. Aerzte 65 (1893) 19..

### (33) SPECTROTELESCOPES.

*Beck, A.* Astron. Nachr. 140 (1896) 119-123.

*Belopolski, A.* Astrophys. J. (1895) 366-371; Beibl. (1896) 25.

— —. Astrophys. J. 3 (1896) 147-149.

*Brooks, W. R.* Mon. Not. 55 (1895) 324.

*Bruce.* (Spectroscope.) Astrophys. J. (1896) 266-281.

*Common, A. A.* Mon. Not. 55 (1895) 325.

*Davies, C. D. P.* Mon. Not. 55 (1895) 400-404.

*Denning, W. F.* Nature 52 (1895) 232-234.

*Deslandres, H.* C.-R. 115 (1892) 783-786.

*Grubb, H.* Nature 38 (1889) 441-444.

— —. Proc. Roy. Soc. Dublin 6 (1890) 598-602; Ztsch. f. Instrum. (1890) 327-329.

*Hale, G. E.* Astrophys. J. 5 (1897) 119-131.

— — —. Astrophys. J. 5 (1897) 211.

*Hastings, C. S.* Astrophys. J. 9 (1899) 162-166; Amer. J. Sci. (4) 7 (1899) 267-271.

*Howe, H. A.* Astron. and Astrophys. 13 (1894) 709-714, 826-830.

*Huggins, Sir W.* Astrophys. J. (1895) 359-365; Beibl. (1896) 196.

- Hurion, A.* J. de phys. (3) 1 (1892) 414-424.
- Keeler, J. E.* Astrophys. J. (1895) 101-111; Beibl. (1896) 25.
- . Astrophys. J. 1 (1895) 248-252.
- . Astrophys. J. 3 (1896) 154-156.
- . Astrophys. J. 9 (1899) 269-271.
- Klein, H. J.* Sirius 24 (1895) 1-6, 193.
- Konkolk, N. von.* Centralztng. f. Opt. u. Mech. 9 (1888) 25-27  
Beibl. (1888) 335.
- . Centralztng. f. Opt. u. Mech. 15 (1894) 61-64.
- Lohse, O.* Centralztng. f. Opt. u. Mech. 11 (1890) 85-86; Beibl. (1890) 588.
- Michelson, A. A.* Astrophys. J. (1895) 60-62; Beibl. (1896) 25.
- Muller, F. C. G.* Z. phys. u. chem. Unterr. 8 (1895) 354-357; Beibl. (1896) 363, 646.
- Newall, H. F.* Proc. Cambridge (Mass.) Phil. Soc. 9 (1896) 179-183; Astrophys. J. 3 (1896) 266-280; Beibl. (1897) 335; Mon. Not. 56 (1896) 98-110.
- Pickering, E. C.* Ann. Harv. Coll. Observ. (1888) 1; Beibl. (1889) 815.
- . Astron. Nachr. 142 (1897) 367-369.
- . Astrophys. J. 9 (1899) 175-178; Harv. Coll. Observ. Cir. No 39.
- Schaeberle, J. M.* Astron. J. 16 (1896) 25-28.
- Scheiner, J.* Ztsch. f. Instrum. 17 (1897) 57-60.
- Steinheil, R.* Ztsch. f. Instrum. 16 (1892) 418.
- Stoney, G. J.* Mon. Not. 56 (1896) 452-459; Astrophys. J. 4 (1896) 238-243.
- Strehl, K.* Leipzig, Barth, 1894. 136 pp.
- . Sirius 23 (1895) 159-163.
- . Ztsch. f. Instrum. 17 (1897) 50-54; Beibl. (1898) 836.
- . Ztsch. f. Instrum. 17 (1897) 77-81.
- . Centralztng. f. Opt. u. Mech. (1897) 91; Beibl. (1898) 838.
- . Centralztng. f. Opt. u. Mech. 18 (1897) 171; Beibl. (1898) 837.
- Sureau, H.* C.-R. 118 (1894) 1253-1255.
- Voigt, H. C.* Sitzb. Berliner Akad. (1896) 1219-1231.
- Wadsworth, F. L. O.* Astron. and Astrophys. 13 (1894) 527-538.  
723-728.
- . Astrophys. J. (1895) 52-79.
- . Astrophys. J. 3 (1896) 169-191, 321-347.
- . Astrophys. J. 5 (1897) 132-142.

- Rayleigh, Lord* (*Cont'd*). *Chem. News* 72 (1895) 152; *Beibl.* (1896) 192.  
 — — and *W. Ramsay*. *Proc. Roy. Soc.* 57 (1895) 265-287.  
 — —. *Nature* 52 (1895) 52-57.  
 — — and *W. Ramsay*. *Smithsonian Contributions* (1896) 43 pp.  
 — —. *Proc. Roy. Soc.* 59 (1896) 198-208.  
 — —. *Proc. Roy. Soc.* 60 (1896) 56-57.  
 — —. Read before the Roy. Inst., Jan. 17, 1896, 10 pp.  
*Remsen, Ira*. *Sci.* 1 (1895) 309-311.  
*Rizzo, G. R.* *Atti Accad. Torino* 32 (1896) 12 pp.; *Beibl.* (1898) 666.  
*Runge, C.* *Astrophys. J.* 9 (1899) 281-284.  
*Rydberg, J. R.* *Astrophys. J.* 6 (1897) 338-348; *Beibl.* (1898) 154.  
*Schlösingfils, Th.* *C.-R.* 121 (1895) 525-528.  
*Troost, L., et Ouwvrad, L.* *C.-R.* 21 (1895) 394-396.  
 — —. *C.-R.* 121 (1895) 798-800.  
*Trowbridge, J., and Richards, T. W.* *Amer. J. Sci.* (4) 3 (1897) 15-21.  
*Waller, E.* *School of Mines Quarterly* (3) 16 (1895) 220-226.  
*Zaleski, J.* *Ber. chem. Ges.* 30 (1897) 965-967.

#### *Aromatic Compounds.*

- Costa, T.* *Gazz. chim. Ital.* (1889) 478; *Jahresb.* (1890) 390.  
*Weigle, Al.* *Ztsch. f. physikalische Chem.* 11 (1893) 227-247.

#### *Arsenic.*

- Humphreys, W. J.* *Astrophys. J.* 6 (1897) 169-232.  
*Kayser, H., und C. Runge.* *Abhandl. d. Berliner Akad.* (1893) 20 pp.  
*McLeod, H.* *Rept. Brit. Assoc.* (1894) 615; *Chem. News* 70 (1894) 139.

#### ASTRONOMICAL IN GENERAL.

- Bailey, S. J.* *Annals Harvard Observ.* 34 (1895) 1-259.  
*Berberich, A.* *Naturwiss. Rundsch.* 14 (1899) 377-380; *Beibl.* (1899) 785-787.  
*Bouguer, P.* *Mem. Acad. Sci. France*, 1739 et 1749.  
*Campbell, W. W.* *Astrophys. J.* 2 (1895) 163.  
 — — —. *Astron. and Astrophys.* 13 (1894) 448-476; *Beibl.* (1895) 67.  
 — — —. *Astrophys. J.* 2 (1895) 177-184; *Beibl.* (1896) 372.  
 — — —. *Astrophys. J.* 8 (1898) 292.  
 — — —. *Astrophys. J.* 9 (1899) 31-36.  
 — — —. *Astrophys. J.* 8 (1898) 291.



- Cerulli, V.* Mem. Spett. Ital. 26 (1897) 71-74.  
*Christie, W. H. M., and F. W. Dyson.* Mon. Not. 56 (1896) 114-134.  
*Clerke, A. M.* Obser'y 18 (1895) 193-196.  
*Deslandres, H.* C.-R. 113 (1891) 737-739; 115 (1893) 783-786; Beibl. (1894) 340.  
 ——. Bull. Soc. astron. France 1 (1895) 368-373; Beibl. (1897) 343.  
 ——. C.-R. 126 (1898) 1323-1326.  
*Draper Catalogue of Stellar Spectra.* See Pickering, below.  
*Dreyer, J. L. E.* Nature 50 (1894) 565-567 Abs.  
*Dufour, Ch.* Arch. de Genève (3) 1 (1896) 314.  
 ——. Arch. de Genève (4) 7 (1899) 209-217.  
*Duner, N. C.* Astrophys. J. 9 (1899) 119-132; Beibl. (1899) 790.  
*Easton, C.* Knowledge 18 (1895) 179-182; Beibl. (1896) 39.  
*Eddie, L. A.* Jour. B. A. A. 5 (1894) 89-98.  
*Elger, T. G.* Observ. 19 (1896) 156-158, 199-201, 236-238, 267-268, 302-308, 328-330, 363-364.  
*Espin, T. E.* Astron. Nachr. (1887) 48-52; Beibl. (1888) 195.  
 ——. Astron. Nachr. 122 (1889) 257-259; Beibl. (1890) 1101.  
 ——. Astron. Nachr. 124 (1890) 177-180; Beibl. (1891) 109.  
 ——. Astron. Nachr. 137 (1895) 369-375.  
 ——. Eng. Mech. 62 (1895) 334.  
 ——. Astron. Nachr. 140 (1896) 241-251.  
*Faye, H.* C.-R. 124 (1897) 797-800.  
*Fizeau.* 121 (1895) 516.  
*Flammarion, C.* C.-R. 121 (1895) 957-860.  
*Fleming, M. L.* Astron. Nachr. 125 (1890) 155-156; Beibl. (1891) 208.  
 ——. Astron. and Astrophys. 12 (1893) 810; 13 (1894) 1.  
 ——. Astrophys. J. 1 (1895) 411-415; 2 (1895) 354-359; Beibl. (1896) 700.  
 ——. Astrophys. J. 8 (1898) 232.  
*Fowler, A.* Nature 45 (1892) 427-428.  
 ——. Nature 56 (1897) 206-208.  
 ——. Knowledge 20 (1897) 77-78, 118.  
*Franklin, W. S.* Sci., n. s. 9 (1899) 594-595.  
*Franks, W. S.* Jour. B. A. A. 5 (1895) 455-458.  
*Frost, E. B.* Pub. A. S. P. 7 (1895) 317-326.  
*Gemmill, S. M. B.* Jour. B. A. A. 5 (1895) 303-305.  
*Gill, D.* Astrophys. J. 10 (1899) 272-282.  
*Gore, J. E.* Astron. and Astrophys. (1892) 11-12.

- Gothard, F. von. Beibl. (1888) 248, 664.  
 Grus, G. (Book) Prag, 1897.  
 Hale, G. E. Astrophys. J. 1 (1895) 180-188.  
 ——. Astrophys. J. 3 (1896) 156-161.  
 ——. Astrophys. J. 9 (1899) 271-272.  
 ——. Astrophys. J. 9 (1899) 273.  
 Hall, M. Mon. Not. 57 (1897) 357-378.  
 Hausdorff, F. Ber. sachs. Ges. d. Wiss. IV (1892) 481-566.  
 Homann, H. Diss., Berlin, 1885, 26 pp.; Beibl. (1887) 146.  
 Huggins, W. Nature 55 (1897) 316.  
 Innes, R. T. A. Jour. B. A. A. 5 (1895) 402-405.  
 Jager, G. Monatsh. f. Math. u. Phys. (1891) 1-22; Beibl. (1891) 419, (1892) 363.  
 Janssen, J. C. R. 117 (1893) 419-423; Beibl. (1894) 561.  
 ——. Bull. Soc. astron. France 1 (1895) 329-335.  
 ——. C.-R. 120 (1895) 1237-1240.  
 ——. Ann. Bur. Longit. D. 1 (1896) 1.  
 ——. C.-R. 123 (1896) 585-587.  
 ——. Bull. Soc. Astr. France (1897) 269-279.  
 Keeler, J. E. Astron. Nachr. 136 (1894) 77-80; Beibl. (1895) 60.  
 ——. Astrophys. J. 6 (1897) 271-288.  
 ——. Astrophys. J. 8 (1898) 113.  
 Kompf, P., and Mueller, G. Astrophys. J. (1895) 428-432.  
 Kleiber, J. Bull. Soc. chim. Paris 45 (1896) 244; Beibl. (1887) 68.  
 Klumpke, D. Bull. astronom. 7 (1890) 287-294; Beibl. (1890) 1100.  
 Kobold, H. Astron. Nachr. 137 (1895) 343-348; Beibl. (1896) 32.  
 ——. Astron. Nachr. 140 (1896) 142-144.  
 Konkoly, N. von. Halle. H. W. Schmidt, 1894, 107 pp.  
 Krueger, Fr. Beibl. (1894) 98.  
 ——. Astron. Nachr. 138 (1895) 239.  
 ——. Astron. Nachr. 139 (1896) 243-248.  
 Kumell, H. Astron. Nachr. (1887) 247, Beibl. (1888) 250.  
 Lagrange, E., et P. Stroobant. Bull. Acad. Belgique (3) 23 (1892) 811-827.  
 Langley, S. P. Smithsonian Reports, 1888-1899.  
 Lehmann-Filhes, R. Astron. Nachr. 139 (1896) 305-310.  
 Ligondes, du. C.-R. 124 (1897) 396-398.  
 Lindemann, E. Bull. Acad. St. Petersbourg Mel. 7 (1890) 83-88; Beibl. (1891) 354.  
 Lockyer, J. N. Proc. Roy. Soc. 43 (1888) 1-93; Beibl. (1889) 504.  
 ——. Proc. Roy. Soc. 47 (1890) 39-41; Beibl. (1890) 516.

- Lockyer, J. N.* Nature 42 (1890) 545-551; Beibl. (1891) 109.  
 ———. Proc Roy Soc 49 (1891) 443-446; Phil. Trans. 182  
 (1891) 397-448; Beibl. (1891) 647, (1898) 1067.  
 ———. Nature 55 (1897) 249-253.  
 ———. Nature 55 (1897) 304-305, 341-342.  
 ———. Nature 56 (1897) 395-396.  
 ———. Proc Roy. Soc 60 (1897) 475-476; Beibl. (1897) 59-61.  
 ———. Proc. Roy. Soc. 61 (1897) 148-209, Nature 56 (1897)  
 91-92.  
 ———. Proc. Roy. Soc. 62 (1897) 52-67.  
 ———. Chem News 78 (1898) 233-235; Beibl. (1899) 181.  
*Lockyer, N.* Nature 60 (1899) 52-54.  
 ———. Chem. News 79 (1899) 145-147; Beibl. (1899) 792.  
*Lohse, O.* (Book.) Leipzig: Weber, 1894. 192 pp.  
*Lord, H. C.* Astrophys. J. 8 (1898) 65-69.  
*Lowell, P.* Astron. Nachr. 141 (1896) 424.  
 ———. Rept. Brit Assoc (1897) 585.  
*McClean, F.* Proc. Roy Soc 62 (1898) 417-423; Astrophys. J. 7  
 (1898) 367-372.  
 ———. London: E. Stanford, 1898; Beibl. (1899) 394.  
*McDonall, F. K.* Jour. B. A. A. 5 (1895) 517-519.  
*Mascari, A.* Astrophys J (1895) 119-126.  
*Maunder, E. W.* Knowledge 18 (1895) 36-38.  
 ———. Knowledge 20 (1897) 98-99.  
*Maurer, F.* Repert. d. Phys 25 (1889) 642-654; Beibl. (1890) 375.  
 ———. Meteorol. Ztschr 7 (1890) 18-25.  
*Mauzy, A. C.* Naturwiss Rundsch. 12 (1897) 581-583.  
*Messerschmitt, F. B.* Phys. Ges Zurich (1889) 57-66; Beibl. (1891)  
 108.  
*Michelson, A. A.* Phil. Mag. (5) 30 (1890) 1-21; Beibl. 14 (1890) 804.  
*Miethe, A.* Rostock; E. Volkmann, 1890, 60 pp.; Beibl. (1890) 378.  
*Minchin, G. M.* Proc. Roy. Soc 58 (1895) 133-151; 59 (1896) 231-  
 233.  
*Monck, W. H. S.* Astron. and Astrophys. 12 (1893) 811-812.  
 ———. Knowledge 18 (1895) 38.  
 ———. Jour. B. A. A. 5 (1895) 164.  
*Muller, F. C. G.* Pub. Observ. Potsdam 8 I (1891) 1-101; Beibl.  
 (1893) 1063.  
*Muller, G., u. P. Kempf.* Potsdam, 1899, 4to, 465 pp.; Astrophys.  
 J. 10 (1899) 59-69.  
 ———. Mem Spettr. Ital. 27 (1898) 51-66.

*Nature* (Editor of). *Nature* 53 (1896) 448-449.

*Newcomb, S.* *Astrophys. J.* 6 (1897) 289-309.

*Nichols, E. L.* *Trans. Kansas Acad.* 10 (1886) 111-121; *Beibl.* 12 (1888) 529.

*Observatory* (Editor of). *Observ.* 19 (1896) 262-264, 358-361.

*O'Gyalla Observatorium.* *Astrophys. J.* 2 (1895) 81 Abs.

*Oppolzer, E. von.* *Astron. Nachr.* 135 (1894) 159-162; *Beibl.* (1894) 763.

*Perrotin.* *C.-R.* 121 (1895) 542-545.

*Pickering, E. C.* *Astron. Nachr.* 122 (1889) 159-160.

———. *The Draper Catalogue*, *Ann. Harv. Observ.* 27 (1890) 388 pp., 4to.

———. *Astron. Nachr.* 128 (1891) 377-380; *Beibl.* (1894) 97.

———. *Astron. and Astrophys.* (1893) 718-722; *Beibl.* (1894) 673.

———. *Astrophys. J.* (1895) 89-96; *Beibl.* (1896) 197.

———. *Astrophys. J.* (1895) 154-159.

———. *Astrophys. J.* 4 (1896) 305.

———. *Astrophys. J.* 141 (1896) 37.

———. *Astrophys. J.* 5 (1897) 350-353.

———. *Astrophys. J.* 6 (1897) 349-352.

———. *Astrophys. J.* 8 (1898) 119.

———. *Astrophys. J.* 8 (1898) 116-118; *Harv. Observ. Cir.* No. 32 (1898).

———. *Astrophys. J.* 9 (1899) 116-117; *Harv. Observ. Cir.* 37 (1899).

———. *Harv. Observ. Cir. No.* 9 (1896); *Astrophys. J.* 4 (1896) 142.

*Pickering, S. U.* *Phil. Mag.* (5) 32 (1891) 478-480.

*Plummer, W. E.* *Mon. Not.* 57 (1897) 294-296.

*Rayleigh, Lord.* *Phil. Mag.* (5) 36 (1893) 129-142; *Beibl.* (1894) 564.

*Riccò, A.* *Mem. Spettr. Ital.* 22 (1893) 3 pp.; *Beibl.* (1894) 917.

———. *Mem. Spettr. Ital.* 28 (1899) 137-152.

———, *T. Zona e Saija, G.* *Mem. Soc. Spettr. Ital.* 28 (1899) 76-89.

*Ritter, A.* *Astrophys. J.* 8 (1898) 293-315.

*Roberts, A. W.* *Astrophys. J.* 4 (1896) 184-195.

*Roberts, I.* *Mon. Not.* 56 (1896) 372-378.

———. *Knowledge* 20 (1897) 10-11.

*Rydberg, J. R.* *Nature* 58 (1898) 319.

*Scheiner, J.* *Pub. astrophys. Observ. Potsdam* 7 (1897) 171-335; *Beibl.* (1898) 362.

- Schlesinger, F.* *Astrophys. J.* 10 (1899) 242-245.  
*Schwarzschild, K.* *Astron. Nachr.* 143 (1897) 1-11.  
*See, T. F. F.* *Astron. Nachr.* 139 (1896) 17-26, 161-164; *Beibl.* (1896) 371; (1897) 344.  
*Sirius (Editor of).* *Sirius* 25 (1897) 12-16.  
*Smithsonian Institution, Astrophysical Observatory Repts.,* 1886-1899.  
*Stanley, W. F.* London: Kegan Paul, 1895, 260 pp.; *Astrophys. J.* 4 (1896) 159.  
*Stone, E. F.* *Mon. Not.* 57 (1896) 9.  
*Stoney, G. F.* *Trans. Roy. Soc. (2)* 6 (1897) 305-328; *Astrophys. J.* 7 (1898) 25-55.  
*Struve, L.* *Mem. Acad. St. Petersburg.* (7) 35 (1887) 110-115; *Beibl.* (1888) 794.  
*Tikhoff, G. A.* *Mem. Spett. Ital.* 27 (1898) 41.  
*Tucker, R. H.* *Pub. Astr. Soc. Pac.* 8 (1896) 95-98.  
*Vogel, H. C.* *Vierteljahrss. d. astron. Ges.* 22 (1887) 57-59.  
 — — —. *Astron. Nachr.* (1888) 1-6; *Beibl.* (1889) 81.  
 — — —. *Sitzb. Berliner Akad.* 15 März, 1888; *Beibl.* (1889) 166, 947.  
 — — —. *Sitzb. Berliner Akad.* (1889) 397-401.  
 — — —. *Sitzb. Berliner Akad.* 28 (1891) 533-539; *Beibl.* (1892) 155.  
 — — —. *Pub. astrophys. Observ. Potsdam* 7 (1892) 166 pp.; *Beibl.* (1893) 128.  
 — — —. *Sitzb. Berliner Akad.* (1895) 947-958; *Beibl.* (1896) 372.  
 — — —. *Astrophys. J.* 7 (1898) 249-254.  
 — — —. *Astrophys. J.* 9 (1899) 1-14.  
 — — — und *J. Wilsing.* *Pub. astrophys. Observ. Potsdam* 12 (1899) 73.  
*Wadsworth, F. L. O.* *Astrophys. J.* 6 (1897) 119-135.  
 — — —. *Astrophys. J.* 7 (1898) 198-207.  
*Waugh, W. R.* *Observ.* 18 (1895) 234.  
*Weyer, G. D. E.* *Astron. Nachr.* 138 (1895) 169-175.  
*Wiedemann, E., und G. C. Schmidt.* *Ann. Phys. u. F.* 57 (1896) 447-453.  
 — — —. *Wochenschr. f. astron. Meteorol. u. Geogr.* 33 (1890) 133.  
 — — —. *Vierteljahrss. d. astronom. Ges.* 31 (1897) 250, 258-261.  
*Wilsing, J.* *Sitzb. Berliner Akad.* 23 (1899) 426-436; *Beibl.* (1899) 790.

ALGOL

- Observatory (Editor of).* *Observ.* 18 (1895) 229-231.

*Wilsing, J.* Astron. Nachr. 124 (1890) 121-186; Beibl. (1890) 904.

## ALTAIR.

*Deslandres, H.* C.-R. 121 (1895) 629-632; Beibl. (1896) 372.

## ANDROMEDA.

*Espin, T. E.* Nature 40 (1889) 656; Beibl. (1890) 284.

*Huggins, W.* Rept. Brit. Assoc. (1885) 932.

*Lindemann, E.* Astron. Nachr. 139 (1896) 345-347.

*Pickering, E. C.* Astrophys. J. (1895) 305-308.

*Tomlinson, H.* Nature 40 (1889) 656.

## ANTLIAE.

*Pickering, E. C.* Astron. Nachr. 142 (1896) 9-12.

## AQUILAE.

*Plassmann, J.* Astron. Nachr. 139 (1895) 171-174.

*Vogel, H. C.* Sitzb. Berliner Akad. (1898) 721-734; Beibl. (1899) 181.

*Wright, W. H.* Astrophys. J. 9 (1899) 59-68.

## ARCTURUS.

*Huggins, Sir W., and Lady Huggins.* Astrophys. J. 6 (1897) 322-327.

## ARGUS.

*Innes, R. T. A.* Mon. Not. 57 (1897) 155.

## AURIGAE.

*Barnard, E. E.* Astrophys. J. 5 (1897) 277.

*Bigourdan, G.* C.-R. 117 (1893) 655-657; Beibl. (1894) 565.

*Campbell, W. W.* Astron. and Astrophys. 12 (1893) 722-730.

— — —. Astrophys. J. (1895) 49-51; Beibl. (1895) 432.

*Clerke, A. M.* Astron. and Astrophys. (1892) 504-513; Beibl. (1893) 207.

*Copeland, R.* Trans. Roy. Soc. Edinburgh, 37 (1893) 1.

*Deslandres, H.* C.-R. 115 (1892) 222-225; Beibl. (1893) 566.

*Gothard, E. von.* Ber. aus. Ungarn 10 (1892) 246-249; Beibl. (1894) 101.

- Huggins, Sir W.* Roy. Inst. Gt. Britain, May 13, 1892, 10 pp.  
 ——. Proc. Roy. Soc. 54 (1892-1893) 30-36.  
 ——— and *Lady Huggins*. Proc. Roy. Soc. 50 (1891) 465.  
 ———, ———. Proc. Roy. Soc. 51 (1891) 486-495.  
*Lindemann, E.* Bull. Acad. St. Petersburg. n. s. 3 (1893) 507-530; Beibl. (1894) 101.  
*Lockyer, J. N.* Proc. Roy. Soc. 50 (1891) 407-409, 466-469.  
*Maury, A. C.* Harvard Conference, Aug. 20, 1898; *Astrophys. J.* 8 (1898) 173-175.  
*Pickering, W. H.* *Astron. and Astrophys.* 13 (1894) 201-204; Beibl. (1895) 175.  
*Runge, C., and F. Paschen.* *Nature* 52 (1895) 544.  
*Schumann, V.* *Astron. and Astrophys.* 12 (1893) 159-166; Beibl. (1893) 826.  
*Schur, W.* *Astron. Nachr.* 138 (1895) 109-111.  
*Seeliger, H.* *Astron. Nachr.* 130 (1892) 393-406; Beibl. (1894) 102.  
*Stone, E. J.* *Mon. Not.* 57 (1897) 401.  
*Vogel, H. C.* *Astron. Nachr.* 126 (1891) 265-272; Beibl. (1891) 355.  
 ———. *Abhandl. d. Berliner Akad.* (1893) 157-217; Beibl. (1893) 932.

B. D. (STAR)

- Becker, E.* *Astron. Nachr.* 137 (1895) 291.  
*Campbell, W. W.* *Astron. Nachr.* 134 (1893) 133-134; Beibl. (1894) 565.  
*Villiger, W.* *Astron. Nachr.* 142 (1897) 337.

CAPRICORNI

- Campbell, W. W.* *Astrophys. J.* 10 (1899) 241.

CARINA.

- Pickering, E. C.* *Astron. Nachr.* 139 (1895) 119-120; Beibl. (1897) 345.

CASSIOPEIAE

- Lockyer, J. N.* Proc. Roy. Soc. 57 (1895) 173-177.

CENTAURI

- Hussey, W. J.* *Pub. A. A. S.* 8 (1896) 220-222.  
*Markwich, E. F.* *Mon. Not.* 56 (1895) 35-38.



*Pickering, E. C.* Astron. Nachr. 140 (1896) 24.

*Roberts, A. W.* Astron. Nachr. 139 (1895) 7-11, 11-14, 177-190.

———. Astron. Nachr. 142 (1896) 51-55.

———. Mon. Not. 56 (1896) 500.

## CEPHEI.

*Lockyer, J. N.* Proc. Roy. Soc. 59 (1896) 9; Beibl. (1896) 700.

*Pickering, E. C.* Astron. Nachr. 142 (1896) 9-12.

## CLADNI.

*Hnatek, A.* Sirius 25 (1897) 98-102.

## COMETS.

*Archenhold, F. S.* Verh. deutsch. Naturf. u. Aerzte (1893) 19.

*Backlund, O.* Mem. Acad. St. Petersb. (7) 34 (1886) 41 pp.; Beibl. (1888) 409.

*Barnard, E. E.* Ann. Phys. Beibl. (1891) 207; Astron. Nachr. 125 (1890) 177-196.

———. Astrophys. J. 3 (1896) 41-46; Phil. Mag. (5) 42 (1896) 41-46.

*Begouen.* Rev. sci. 30 (1847) 297.

*Berberich, A.* Astron. Nachr. (1888) 49-66; Beibl. (1889) 165.

———. Naturwiss. Rundsch. 14 (1899) 365-377; Beibl. (1899) 785-787.

*Bredikhine, Th.* Bull. Akad. St. Petersb. 5 II (1895) 383-397.

*Callandreaux, O.* C.-R. 123 (1896) 663-664.

*Campbell, W. W.* Astron. Nachr. 133 (1893) 149-152; Beibl. (1894) 766.

*Charlois.* C.-R. 109 (1889) 400; Beibl. (1890) 38.

*Colton, A. L.* Pub. A. S. P. 8 (1896) 194.

*Corrigan, S. J.* Astron. and Astrophys. (1892) 362-367.

*Fessenden, R. A.* Astrophys. J. 3 (1896) 36-40.

*Fric, Josef, u. Jan.* Astron. Nachr. 140 (1896) 63-64, 253.

*Gothard, E. von.* Astron. Nachr. 103 (1882) 377-380; Beibl. (1883) 116.

*Hartmann, J.* Astron. Nachr. 141 (1896) 253.

*Holetschek, J.* Astron. Nachr. 137 (1895) 237-238.

———. Vierteljahrss. d. astron. Ges. 31 (1897) 250, 261-265.

———. Astron. Nachr. 143 (1897) 113-121.

*Hussey, W. J.* Pub. A. S. Pac. 7 (1895) 185-191.

- Kayser, H.* Astron. Nachr. 134 (1894) 353-356; Beibl. (1894) 766  
*Klaer, J.* Astron. Nachr. 126 (1890) 281-292; Beibl. (1891) 646  
*Lockyer, J. N.* Proc. Roy. Soc. 47 (1890) 28-39.  
 — — — Proc. Roy. Soc. 48 (1890) 217-220; Beibl. (1891) 35.  
*Marcuse, A.* Naturwiss. Rundsch. 4 (1889) 609; Beibl. (1890) 283.  
*Millosewich, E.* Atti Accad. Roma 4 (1895) 268-269.  
 — — — Rend. Accad. Lincei Roma 7 I (1898) 252.  
*Perrotin, J.* C.-R. 123 (1896) 925-928.  
*Rydberg, J. R.* Beibl. (1899) 99.  
*Schaeberle, J. M.* Astron. and Astrophys. (1894) 304-308.  
*Schiaparelli.* Astron. Nachr. 124 (1890) 225-234; Beibl. (1891) 108.  
*Vogel, H. C.* Astron. Nachr. 135 (1894) 105-108; Beibl. (1894) 766.  
*Wellmann, V.* Bull. astron. 12 (1895) 515-522.  
*Wesley, W. H.* Observ. 17 (1894) 349-353.  
*Wright, W. H.* Astrophys. J. 10 (1899) 173-176.

CORONA.

- Espin, T. E.* Naturwiss. Rundsch. 6 (1891) 151.

CYGNUS.

- Campbell, W. W.* Amer. J. Sci. (4) 15 (1895) 100.  
*Huggins, Sir W., and Lady Huggins.* Chem. News 63 (1891) 27-30.  
 39-40.  
 — — — Astrophys. 6 (1897) 322-327.  
*Koehl, T.* Astron. Nachr. 140 (1896) 25.  
*Lockyer, Sir J. N.* Proc. Roy. Soc. 64 (1899) 320-322; Beibl. (1899)  
 361.

D. M. (STAR.)

- Campbell, W. W.* Astron. and Astrophys. 12 (1893) 913.

DOUBLE STARS.

- Belopolsky, A.* Astrophys. J. 5 (1897) 1-7.  
*Burnham, S. W.* Astron. and Astrophys. 13 (1893) 14-20.  
*Campbell, W. W.* Astrophys. J. 10 (1899) 177.  
*Clerke, A. M.* Nature 39 (1888) 55-58; Beibl. (1889) 886.  
 — — — Knowledge 18 (1895) 110.  
*Doberck, W.* Observ. 19 (1896) 268-270.  
*Flamache, A.* Bull. Soc. Belge d'Astron. 1 (1896) 45-49.  
*Everett, A.* Mon. Not. 56 (1896) 462-466.  
*Huggins, Sir W.* C.-R. 125 (1897) 512-514.

*Monck, W. H. S.* Jour. B. A. A. 5 (1895) 416.

*Palisa, J.* Astron. Nachr. 123 (1889) 201-204; Beibl. (1890) 789.

*Pickering, E. C.* Harv. Observ. Cir. No. 11; Astron. Nachr. 142 (1896) 11-13.

— — —. Harv. Observ. Cir. No. 14; Astron. Nachr. 142 (1896) 107-109.

— — —. Harv. Observ. Cir. No. 18; Astrophys. J. 6 (1897) 258-259.

— — —. Harv. Observ. Cir. 21 (1897); Astrophys. J. 7 (1898) 139.

*Roberts, A. W.* Astrophys. J. 2 (1895) 283-292.

*Schwarzschild, K.* Astron. Nachr. 139 (1896) 353-360; Beibl. (1897) 344.

*Wilsing, J.* Astron. Nachr. 134 (1893) 89-92; Beibl. (1894) 673.

*Zwiers, H. J.* Astron. Nachr. 139 (1896) 369-379.

#### GEMINI.

*Hagen, J. G.* Astron. J. 17 (1897) 127.

#### HERCULES.

*Duner, N. C.* Astron. Nachr. 140 (1896) 261-263.

*Lindemann, E.* Astron. Nachr. 137 (1894) 10.

#### HYDRAE.

*Paul, H.* Amer. J. Sci. (4) 15 (1895) 103.

#### JUPITER.

*Abetti, P.* Astron. Nachr. 141 (1896) 134.

*André, Ch.* C.-R. 111 (1890) 876; Beibl. (1891) 207.

*Antoniadi, E.* Bull. Soc. astron. France 2 (1896) 28-30.

*Barnard, E. E.* Astron. and Astrophys. 13 (1894) 736.

*Bélopolsky, A.* Astron. Nachr. 139 (1896) 209-214; Beibl. (1897) 342.

*Boeddicker, O.* Dublin Trans. (2) 4 (1888) 272-288; Beibl. (1889) 687.

*Brenner, L.* Bull. Soc. astron. France 2 (1896) 30-31.

*Childs, H. Y.* Observ. 19 (1896) 403-404.

*Christie, W. H. M.* Mon. Not. 57 (1897) 183-191.

*Cohn, F.* Astron. Nachr. 142 (1897) 289-337.

*Crommelin, A. C. D.* Mon. Not. 56 (1896) 474-475.

- Denning, W. F. *Nature* 53 (1895) 33.  
 — — —. *Observ.* 19 (1896) 326-328.  
 Ellerman, H. O. G. *Astrophys. J.* 9 (1899) 186.  
 Fauth, P. *Astron. Nachr.* 140 (1896) 167.  
 — — —. *Astron. Nachr.* 142 (1897) 375.  
 Gledhill, J. *Mon. Not.* 55 (1895) 391-398.  
 — — —. *Mon. Not.* 56 (1896) 476-494.  
 — — —. *Mon. Not.* 56 (1896) 494-500.  
 Hartmann, J. *Astrophys. J.* 10 (1899) 225-240.  
 Hartwig, E. *Astron. Nachr.* 140 (1896) 167.  
 Henderson, A. *Jour. B. A. A.* 5 (1895) 154.  
 Hough, G. W. *Astron. and Astrophys.* 13 (1894) 89-92.  
 — — —. *Astron. Nachr.* 140 (1896) 273-283.  
 Marth, A. *Mon. Not.* 55 (1895) 486-493; 522-535.  
 — — —. *Mon. Not.* 56 (1896) 516-534.  
 Paterson, A. G. *Jour. B. A. A.* 5 (1895) 211.  
 Quenisset, F. *Bull. Soc. astron. France* (1897) 318-323.  
 Sells, E. P. *Mon. Not.* 57 (1897) 152-154.  
 Terby, F. *Bull. Acad. Belgique* (3) 18 (1889) 373-376; 592-597;  
     *Beibl.* (1890) 282, 788, 982.  
 Villiger, W. *Astron. Nachr.* 140 (1896) 319.  
 Waugh, W. R. *Mem. B. A. A.* 4 (1896) Part II.  
 Wellmann, V. *Beibl.* (1887) 705.

*Line of Sight, see Motion in the Line of Sight and Variables.*

LYRAE.

- Deslandres, H. *C. R.* 112 (1891) 413; *Beibl.* 15 (1891) 355.  
 Huggins, Sir W., and Lady Huggins. *Astrophys.* 6 (1897) 322-327;  
 Frost, E. B. *Astrophys. J.* (1895) 383 384.  
 Keeler, J. E. *Astron. and Astrophys.* 12 (1893) 350-361; *Beibl.*  
     (1894) 100.  
 Lockyer, J. N. *Astron. and Astrophys.* 13 (1894) 575-581; *Proc.*  
     *Roy. Soc.* 56 (1894) 278.  
 Meyers, G. W. *Astrophys. J.* 7 (1898) 1-22.  
 Sherman, O. T. *Amer. J. Sci.* (3) 33 (1887) 126-129; *Beibl.* (1888)  
     50.  
 Vogel, H. C. *Astron. and Astrophys.* 13 (1894) 561-568.

MARS.

- Antoniadi, E. M. *Knowledge* 20 (1897) 169-172.  
 Brenner, L. *Astron. Nachr.* 143 (1897) 41-43.

- Campbell, W. W.* Pub. A. S. Pac. 6 (1894) 228; *Astron. and Astrophys.* 13 (1894) 752-760.  
 — — —. *Astrophys. J.* (1895) 28-44; *Beibl.* (1896) 37.  
 — — —. Pub. A. S. Pac. 7 (1895) 292-293.  
 — — —. *Astrophys. J.* 4 (1896) 79.  
 — — —. Pub. A. S. Pac. 9 (1897) 109-112.  
*Cerulli, V.* *Astron. Nachr.* 141 (1896) 239, 420; 142 (1897) 44-45, 153-155.  
*Douglas, A. E.* *Astrophys. J.* (1895) 127-130; *Beibl.* (1896) 36.  
 — — —. *Astron. Nachr.* 142 (1897) 36-46.  
 — — —. *Bull. Soc. astr. France* (1897) 290-292.  
*Flammarion, C.* C.-R. 119 (1894) 786-791; 121 (1895) 760-763.  
 — — —. *Bull. Soc. astr. France* (1897) 113-118.  
*Hartmann, J.* *Astrophys. J.* 10 (1899) 225-240.  
*Huggins, Sir W.* *Astrophys. J.* 1 (1895) 193-195; *Beibl.* (1896) 36.  
*Hussey, W. J.* *Astron. Nachr.* 141 (1896) 403.  
*Janssen, J.* C.-R. 121 (1895) 233-237; *Beibl.* (1896) 36.  
*Jewell, L. E.* *Astrophys. J.* 1 (1895) 311-317; *Beibl.* (1896) 36.  
 — — —. *Astrophys. J.* 3 (1896) 255-258.  
*Keeler, J. E.* *Astrophys. J.* 5 (1897) 328-331.  
*Lockyer, W. J. S.* *Nature* 54 (1896) 625-627.  
*Lohse, O.* *Astron. Nachr.* 142 (1897) 155.  
*Lowell, P.* *Nature* 52 (1895) 401-405.  
 — — —. *Bull. Soc. astron. France* (1897) 220-227.  
*Marth, A.* *Mon. Not.* 56 (1896) 394-406.  
*Maunder, E. W.* *Mem. B. A. A.* 2, Part 6 (1895) 157-198.  
 — — —. *Knowledge* 20 (1897) 142-144.  
*Observatory (Editor of).* *Observ.* 20 (1897) 132-134.  
*Perrotin, J.* C.-R. 124 (1897) 340-346.  
*Pickering, W. H.* *Bull. Soc. Belge d'Astr.* 2 (1897) 221-224.  
*Peyra, D.* *Mem. Spettr. Ital.* 26 (1897) 61-64.  
*Quenisset.* *Bull. Soc. astr. France* (1897) 227-239.  
*Rheden, J.* *Sirius* 26 (1897) 58-61.  
*Schiaparelli, G. V.* *Bull. Soc. astr. France* (1897) 107-113.  
*Schur, W.* *Mon. Not.* 57 (1897) 150.  
*Terby, F.* *Bull. Soc. Belge d'Astron.* 2 (1897) 50-58.  
*Young, C. A.* Pub. A. S. Pac. 7 (1895) 294.

## MERCURY.

- Brenner, L.* *Astron. Nachr.* 142 (1896) 37-42.  
 — — —. *Astron. Nachr.* 140 (1896) 347.

- Lowell, P.* Mem. Amer. Acad. Sci. 12 (1898) 433-465, with 8 plates.  
*Marth, A.* Mon. Not. 57 (1897) 426-430.  
*Schiaparelli, G. V.* Rend. Accad. Roma (4) 5 (1889) 283-289; Beibl. (1890) 377.  
*Trowelot, E. L.* Bull. Soc. astron. France (3) 2 (1892) 87 pp.

METEORS.

- Anderson, W.* Mon. Not. 57 (1896) 68-69.  
*Arcinus, A.* Nature 53 (1896) 395.  
*Barnard, E. E.* Astrophys. J. 9 (1899) 151-156.  
*Barone, G.* Bull. Soc. Belge d'Astron. 2 (1897) 207-209.  
*Cohen, E.* Sitzb. Berliner Akad. (1898) 607-608.  
*Corder, H.* Mem. Brit. A. A. 4 (1895) 1-20; Rept. Brit. Assoc. (1896).  
*Denning, W. F.* Nature 52 (1895) 33, 395-396  
 ———. Observ. 18 (1895) 93, 213, 270, 325-328.  
 ———. Astron. Nachr. 142 (1896) 89  
 ———. Observ. 19 (1896) 300, 361-363.  
 ———. Mon. Not. 57 (1897) 161-169, 276-280.  
*Flammarion, C.* Bull. Soc. astr. France 2 (1896) 73-78.  
*Foots, W. M.* Nature 55 (1897) 572.  
*Gale, W. F.* Jour. B. A. A. 5 (1895) 407.  
*Gredilla y Gauna.* C.-R. 122 (1896) 1559-1560.  
*Hartley, W. N., and H. Ramage.* Chem. News 76 (1897) 231; Beibl. (1898) 774.  
 ———. Proc. Dublin Soc. 8 IV (1898) 68; 703-710; Beibl. (1898) 667.  
 ———. Trans. Lond. Chem. Soc. 51 (1899) 533; Beibl. (1899) 789.  
*Hasselberg, B.* Astrophys. J. 9 (1899) 143-148.  
*Howell, E. E.* Amer. J. Sci. (3) 50 (1895) 252-254.  
*Hutchins, C. C.* Amer. J. Sci. (3) 39 (1890) 392-395.  
*Fewell, L. E.* Astrophys. J. 9 (1899) 229-230.  
*Keeler, J. E.* Nature 57 (1895) 164-165; Astrophys. J. (1895) 416-427.  
*Lockyer, J. N.* Nature 36 (1887) I, 55-61; II, 80-87.  
 ———. Proc. Roy. Soc. 46 (1889) 380-392; Beibl. (1889) 688.  
 ———. Proc. Roy. Soc. 46 (1889) 401-423; Beibl. (1890) 515, 844.  
 ———. Chem. News 69 (1894) 89; Beibl. (1894) 767.  
 ———. Phil. Trans. 185 (1895) 983-1023, 1023-1029.  
*Merino, M.* C.-R. 122 (1896) 683.

*Merrill, G. P.* Amer. J. Sci. (4) 2 (1896) 149-153.

*Mirat, S. B.* C.-R. 122 (1896) 1352.

*Moisson, H.* C.-R. 121 (1895) 483-486.

*Pickering, E. C.* Harv. Observ. Cir. (1897); Astrophys. J. 6 (1897) 461.

— — —. Astrophys. J. 9 (1899) 178-179.

*Preston, S. T.* Nature 39 (1889) 535.

*Ramsay, W.* Nature 52 (1895) 224-225. C.-R. 120 (1895) 1049-1050.

*St. Meunier.* Bull. Soc. astr. France (1896) 122-123.

*Schweinitz, E. A.* Amer. J. Sci. (4) 1 (1896) 208.

*Tacchini, P.* Atti Accad. Roma 4 (1895) 182-183.

*Thompson, G. C., and Tanner, H. W. L.* Mon. Not. (1897) 158-160.

*Travers, M. W.* Chem. News 78 (1898) 317-318.

*Winchell, N. H.* C.-R. 122 (1896) 681-682.

#### MIRA CETI.

*Lockyer, J. N.* C.-R. 107 (1888) 832-834; Beibl. (1889) 220.

*Nyland, A.* Astron. Nachr. 141 (1896) 419.

*O'Halloran, R.* Pub. A. S. Pac. 8 (1896) 79-81.

*Vogel, H. C.* Sitzb. Berliner Akad. 17 (1896) 395-399; Beibl. (1897) 345.

#### MOON.

*Bosshard, E.* Sirius 23 (1895) 152-153.

*Brooks, W. R.* Sci. Amer. (1895) 395.

*Greene, F.* Rept. Brit. Assoc. (1889) 617.

*Hepperger, J. von.* Sitzb. Wiener Akad. 104 IIa (1895) 189-225; Beibl. (1897) 338.

*Keeler, J. E.* Astrophys. J. 5 (1897) 51-59.—See Loewy and Puiseux in C.-R. 119 (1894) 130-135, 254-259; 121 (1895) 6-12, 79-85; 122 (1896) 967-973.

*Krieger, J. N.* Sirius 26 (1897) 49-52.

*Langley, S. P.* Amer. J. Sci. (3) 36 (1888) 397-410; Phil. Mag. (5) 26 (1888) 505-520.

— — —. Mem. Nat. Acad. Sci. 4 (1890) 159-179.

— — —. Proc. Nat. Acad. Sci. 4 (1889) 107-212; Beibl. (1890) 783.

*Loewy et Puiseux.* C.-R. 122 (1896) 967-973.

*Pickering, W. H.* Bull. Soc. astron. France 1 (1895) 306-316.

*Rosse, Earl of.* Nature 43 (1891) 104.



- See, T. J.* Sirius 23 (1895) 50-56, Amer. J. Sci. (4) 15 (1895) 38.  
*Very, F. W.* Astrophys. J. 2 (1895) 293-305; Beibl. (1896) 669.  
 ———. Astrophys. J. 8 (1898) 199-217; Beibl. (1899) 179.

MOTION IN THE LINE OF SIGHT.

- Campbell, W. W.* Astrophys J. 8 (1898) 157-158.  
*Deslandres, H.* C. R. 115 (1892) 783-786.  
 ———. Astrophys J 9 (1899) 167-173.  
*Frost, L. B.* Astrophys. J. 2 (1895) 235-237; Beibl. (1896) 371.  
*Kleiber, F.* Astron. Nachr. 127 (1891) 209-212; Beibl. (1893) 753.  
*Monck, W. H. S.* Astrophys. J. 8 (1898) 28-31.  
*Moulton, F. R.* Astrophys J 10 (1899) 14-21.  
*Orbinsky, A.* Astron. Nachr. 138 (1895) 9-12; Beibl. (1896) 202.  
*Oudemans, J. A. C.* Astron. Nachr. 137 (1895) 169-171.  
*Pickering, E. C.* Astrophys J. 4 (1896) 370-373; Harv. Observ. Cir. 13 (1896).  
*Schlesinger, F.* Astrophys. J. 10 (1899) 1-13.

NEBULAE.

- Aitken, R. G.* Astrophys. J. 6 (1897) 365.  
*Archenhold, F. S.* Astron. Nachr. 129 (1892) 153-158; Beibl. (1893) 129.  
*Barnard, E. E.* Astron. and Astrophys. 13 (1894) 642-644.  
 ———. Astron. Nachr. 136 (1894) 196; Astron. and Astrophys. 13 (1894) 768-770.  
 ———. Astron. and Astrophys. 13 (1894) 791.  
 ———. Astron. and Astrophys. 13 (1894) 811-814.  
 ——— and *A. C. Ranyard.* Knowledge 17 (1894) 253.  
 ———. Mon. Not. 55 (1895) 442-453.  
 ———. Mon. Not. 55 (1895) 453-456; Astron. Nachr. 138 (1895) 211-214.  
 ———. Mon. Not. 56 (1895) 63-65.  
 ———. Mon. Not. 56 (1895) 66-67.  
 ———. Astrophys J 2 (1895) 350.  
 ———. Astron. Nachr. 139 (1895) 41-43.  
 ———. Astron. Nachr. 140 (1896) 283-285.  
*Belopolsky.* Astron. Nachr. 140 (1896) 23.  
*Berberich, A.* Naturwiss. Rundsch. 9 (1894) 477-480; Beibl. (1895) 336.  
*Bigourdan, G.* C.-R. 123 (1896) 1243-1245; 124 (1897) 65-67, 133-135.

- Campbell, W. W.* *Astron. and Astrophys.* 13 (1894) 384-398, 494-501.
- . *Astrophys. J.* 2 (1895) 161.
- . *Astrophys. J.* 6 (1897) 363.
- . *Astrophys. J.* 8 (1898) 317-319.—See Scheiner, same vol., 295-298.
- . *Astrophys. J.* 9 (1899) 312.
- . *Astrophys. J.* 10 (1899) 22-25.
- Clerke, A. M.* *Observ.* (1889) 363-394.
- Dreyer, J. L. E.* *Mem. Roy. Astron. Soc.* 51 (1895) 185-228.
- . *Mon. Not.* 57 (1896) 44-50.
- Easton, C.* *Nature* 50 (1894) 547.
- Flammarion, C.* *Bull. Soc. astron. France* (1897) 209-212.
- Gothard, E. v.* *Mem. Spettr. Ital.* 21 (1892) 1-5; *Beibl.* (1893) 754.
- . *Ber. aus Ungarn* 10 (1892) 246-249; *Beibl.* (1894) 101.
- Harrer, H.* *Astrophys. J.* 10 (1899) 290.
- Hasselberg, B.* *Mem. Spettr. Ital.* 24 (1895) 1-11.
- Huggins, Sir W., and Lady Huggins.* *Proc. Roy. Soc.* 46 (1889) 40-60.
- . *Proc. Roy. Soc.* 48 (1890) 202-213; *Beibl.* (1891) 35.
- . *Proc. Roy. Soc.* 48 (1890) 213-216; *Beibl.* (1891) 35.
- . *C.-R.* 110 (1890) 1310-1311; *Beibl.* (1890) 790.
- . *Astron. and Astrophys.* 13 (1894) 568.
- . *C.-R.* 125 (1897) 514-515.
- , *Sir W., and Lady Huggins.* *Astrophys. J.* 6 (1897) 322-327.
- Hussey, W. J.* *Pub. A. S. Pac.* 8 (1896) 220-222.
- Keeler J. E.* *Proc. Roy. Soc.* 49 (1891) 399-403; *Beibl.* (1891) 647.
- . *Astron. and Astrophys.* 12 (1893) 730-736; *Beibl.* (1894) 566.
- . *Astron. and Astrophys.* (1894) 476-494; *Beibl.* (1895) 68.
- . *Pub. A. S. Pac.* 7 (1895) 279-282.
- . *Astrophys. J.* 9 (1899) 133-142.
- . *Astrophys. J.* 10 (1899) 167-168.
- . *Astrophys. J.* 10 (1899) 266-268.
- Klein, H. J.* *Sirius* 24 (1895) 14-17.
- Krieger, J. N.* *Sirius* 23 (1895) 270.
- Laska, V.* *Sirius* 23 (1895) 136-137.
- Liveing, G. D., and J. Dewar.* *Phil. Mag.* (5) 34 (1892) 205-209.
- Lockyer, J. N.* *Proc. Roy. Soc.* 47 (1890) 28-39; *Beibl.* (1890) 516.
- . *Proc. Roy. Soc.* 48 (1890) 167-198.
- . *Proc. Roy. Soc.* 56 (1894) 285.

- Lockyer, J. N* (Cont'd). Phil. Trans 186 A (1895) 73-91.  
*Maunder, E. W.* Knowledge 18 (1895) 155, 157, 253; 20 (1897) 120-122.  
*Nacumvala, K. D.* Observ. 18 (1895) 310.  
*Palmer, H. K.* Astrophys. J. 10 (1899) 246-254.  
*Pickering, E. C.* Ann. Harv. Observ. 18 (1888) 113-117.  
 ———. Harvard Coll. Observ. Cir. No. 19 (1897); Astrophys. J. 6 (1897).  
 ———. Astron. Nachr. 140 (1896) 285-287.  
*Preston, S. T.* Nature 39 (1889) 535-536.  
*Rayet, G.* C.-R. 111 (1890) 31-32.  
 ———. C.-R. 127 (1898) 441-442.  
*Ricco, A.* Rend. Accad. Roma (5a) 4 (1895) 341; Beibl. (1896) 203.  
*Roberts, I.* Knowledge 18 (1895) 182.  
 ———. Knowledge 18 (1895) 207-208 —See Maunder, p. 155.  
 ———. Knowledge 18 (1895) 232.  
 ———. Knowledge 18 (1895) 253.  
 ———. Mon. Not. 55 (1895) 398, 399.  
 ———. Mon. Not. 56 (1895) 32-33, 70-71, 378-379, 380-381; 57 (1897) 430-431.  
 ———. Knowledge 20 (1897) 100-101, 218.  
*Ruemker, G.* Mittheil. d. Hamburger Sternwarte, No. 1, 1893.  
*Runge, C.* Astrophys. J. 8 (1898) 32-36.  
*Schaeberle, J. M.* Astrophys. J. 6 (1897) 364-365.  
*Scheiner, J.* Vierteljahrsschr. d. astron. Ges. 32 (1897) 42-52.  
 ———. Astrophys. J. 7 (1898) 231-238.  
 ———. Astrophys. J. 7 (1898) 295-298.  
 ———. Astrophys. J. 9 (1899) 140-150.  
 ———. Astrophys. J. 10 (1899) 164-166.  
*Stone, E. J.* Mon. Not. 57 (1896) 9-10.  
*Stratonoff, W.* Astron. Nachr. 142 (1896) 55-61.  
*Swift, Lewis.* Astron. Nachr. 17 (1896) 27-28.  
*Tisserand, F.* Bull. astron. 12 (1895) 196-198.  
*Vogel, H. C.* Astron. Nachr. (1888) 337-342.  
*Wilczynski, E. J.* Astrophys. J. 4 (1896) 97-100.  
*Wilson, H. C.* Astron. Nachr. 15 (1895) 184.  
*Wolf, M.* Astron. Nachr. 126 (1890) 354.  
 ———. Astron. Nachr. 137 (1895) 175.  
*Wright, W. H.* Astrophys. J. 6 (1897) 365-366.  
*Yendell, P. S.* Sirius 22 (1895) 258-259.

*Denning, W. F.* *Astron. Nachr.* 141 (1896) 171.

*Deslandres, H.* *C.-R.* 120 (1895) 1155-1158.

*Fauth, P.* *Astron. Nachr.* 141 (1896) 401-403.

*Hale, G. E.* *Astrophys. J.* 9 (1899) 185; *Yerkes Observ. Bull.* No. 6 (1899).

*Huggins, W., and Mrs. Huggins.* *Proc. Roy. Soc.* 46 (1889) 231-233.

*Keeler, J. E.* *Astron. Nachr.* 122 (1889) 401-404; *Beibl.* (1890) 119, 1100.

———. *Astron. Nachr.* 139 (1895) 5-7; *Beibl.* (1896) 370.

———. *Sci. n. s.* 1 (1895) 519-520.

———. *Mon. Not.* 55 (1895) 474-475.

———. *Astrophys. J.* (1895) 63-68; *Beibl.* (1896) 200.

———. *Astrophys. J.* 1 (1895) 416-427; *Beibl.* (1896) 38; *Nature* 20 (1896) 164-165.

———. *Astrophys. J.* 2 (1895) 163.—See *Deslandres, C.-R.* 120 (1895) 1155.

*Lockyer J. N.* *Nature* 38 (1888) 564.

———. *Proc. Roy. Soc.* 45 (1889) 315-316; *Beibl.* (1889) 509.

*Lynn W. T.* *Observ.* 18 (1895) 235.

*Roberts, C.* *Jour. B. A. A.* 5 (1895) 219-220.

*Seeliger, H.* *Sitzb. Bayer. Akad.* 16 II (1887) 114 pp.; *Beibl.* (1888) 356.

———. *Astron. Nachr.* 138 (1895) 99-101, 416-427; *Beibl.* (1896) 38.

*Terby, F.* *Astron. Nachr.* 122 (1889) 105-108; *Beibl.* (1890) 1177.

———. 121 (1889) 109-111, 173-174, 233-234, 305-306, 335-336, 367-368; *Beibl.* (1889) 1010.

*Trouvelot.* *Bull. astron.* 7 (1890) 7-22, 185-194; *Beibl.* (1890) 983.

*Williams, A. S.* *Observ.* 19 (1896) 116-118.

*Wonaszek, A.* *Sirius* 24 (1896) 219.

*Young, C. A.* *Sirius* 22 (1895) 249-253.

#### SIRIUS.

*Holden, E. S.* *Astron. Nachr.* 142 (1896) 13.

*Huggins, W., and Mrs. Huggins.* *Proc. Roy. Soc.* 48 (1890) 216-217; *Beibl.* (1891) 790.

*Hussey, W. J.* *Pub. A. S. Pac.* 8 (1896) 183-186.

*Lynn, W. T.* *Astrophys. J.* 1 (1895) 351.

*Schiaparelli, G.* *Atti Accad. Agiati* (3) 2 (1896) 37.

*See, T. J. J.* *Astron. and Astrophys.* (1892) 269-274.

## SOLAR IN GENERAL.

- Abney, W. de W.* Phil. Trans. 177 Part II (1886) 459-469; Beibl. (1888) 351.
- Anding, E.* Astron. Nachr. 140 (1896) 1-17.
- Angstrom, K.* Bih. Svensk. Akad. Handl. 15 Afd. I, No. 10 (1889) 19 pp.
- Arrhenius.* Meteorolog. Ztschr. 5 (1888) 297-304.
- Bartoli, A.* Bol. Accad. Catania 15 (1890) 5 pp.
- Baume-Pluvinel, A. de la.* C.-R. 128 (1899) 269-272.
- Becker, L.* Edinburgh Trans 36 (1890) 99-210, with plates; Beibl. (1891) 352.
- Bélopolsky, A.* Astron. Nachr. 125 (1890) 17-22, 251-254; Beibl. (1890) 621; (1891) 107.
- Bigelow, F. H.* Astron. and Astrophys. 13 (1893) 26-40.
- Brennand, W.* Proc. Roy. Soc. 49 (1891) 255-280.
- Brester, A., Jr.* Amsterdam Akad. Verh. I. Sect. (1892) 168 pp.; Beibl. (1893) 447.
- Brown, Miss E.* Mem. Brit. Astron. Assoc. 3, III (1895) 49-120.
- Catalogue of Oscillation Frequencies.* Rept. Brit. Assoc. (1878).
- Chatelier, H. Le.* C.-R. 114 (1892) 737-739; Beibl. (1893) 566.
- Colton A. L.* Pub. A. S. Pac. 7 (1895) 285.
- Cornu, A.* Ann. chim. phys. (6) 7 (1886) 5-102; Beibl. (1887) 37.
- Crew, H.* Amer. J. Sci. (3) 38 (1889) 204-213; Beibl. (1890) 120.
- Deslandres, H.* C.-R. 115 (1892) 222-225.
- . C.-R. 115 (1892) 783-786.
- . C.-R. 119 (1894) 148-151; Beibl. (1895) 67.
- . Paris: Fillon et Heuse, 1897; Beibl. (1898) 561.
- Evershed, J.* Jour. B. A. A. 5 (1895) 345-349.
- Exner, F.* Sitzb. Wiener Akad. 94 II (1886) 345-356.
- Fényi, J.* Astrophys. J. 4 (1896) 18-37.
- Ferrel, W.* Amer. J. Sci. (3) 41 (1891) 378-386; Beibl. (1891) 645.
- Fowler, A.* Nature 38 (1888) 492-493.
- Garbasso, A., et A.* Arch. de Genève (4) 3 (1897) 105-113.
- Guillaumc, J.* C.-R. 119 (1894) 529, 1186, 10 (1895) 250, 1250; 121 (1895) 710-712, 1120-1122; 122 (1896) 590-593; 123 (1896) 732-734, 482-484; 14 (1897) 449.
- Hadden, D. E.* Pub. A. S. Pac. 7 (1895) 299-305; 9 (1897) 77-85.
- Hartmann, J.* Sitzb. Berliner Akad. 46 (1898) 742-756. Beibl. (1899) 180.
- Higgs, G.* Rept. Brit. Assoc. (1890) 760.

- Higgs, G.* (*Cont. J.* Proc. Roy. Soc. 54 (1893) 200-209; Beibl. (1894) 338.  
 ——. *Astrophys. J.* 7 (1898) 86-89.  
*Huggins, W.* *Chem. News* 71 (1895) 283; Beibl. (1895) 634.  
 ——. *Astron. Nachr.* 138 (1895) 229-230.  
*Hutchins, C. C., and E. S. Holden.* *Phil. Mag.* (5) 24 (1887). 325-330; Beibl. (1888) 473.  
*Jewell, L. E.* *Astrophys. J.* 3 (1896) 50-113; 4 (1896), 138.  
 ——. *Astrophys. J.* 8 (1898) 51-53.  
*Keeler, J. E.* *Astrophys. J.* 1 (1895) 178.—See Wilczynski, same vol., 112.  
*Knopf, O.* *Vierteljahrsschr. d. astron. Ges.* 30 (1895) 24-39.  
*Lamansky, S.* *Sitzb. Berliner Akad.* (1871) 632.  
*Langley, S. P.* *Amer. J. Sci.* (3) 36 (1888) 397-410; *Phil. Mag.* (5) 26 (1888) 505-520.  
 ——. *Mem. Nat. Acad. Sci.* 4 (1890) 159-179.  
 ——. *C.-R.* 119 (1894) 388-392; Beibl. (1894) 1045.  
*Lockyer, J. N.* *Nature* 57 (1896) 156-158, 204-207, 374-377, 396-399, 565-567; 58 (1896) 12-14.  
*Mascari, A.* *Astrophys. J.* 2 (1895) 119-126; 4 (1896) 205-211.  
*Mengarini, G.* *Atti Accad. Roma* 3 (1887) 482-489, 566-573; Beibl. (1887) 705; (1888) 663.  
*Michelson, A. A.* *Astrophys. J.* (1895) 1-9; Beibl. (1895) 428.  
 ——. *Astrophys. J.* 2 (1895) 60-62.  
*Mohler, J. F., and L. E. Jewell.* *Astrophys. J.* (1896) 351-355.  
*Oppolzer, E. R. von.* *Astron. and Astrophys.* 12 (1893) 736-743; Beibl. (1894) 563.  
 ——. *Vierteljahrsschr. d. astron. Ges.* 30 (1895) 24-39.  
*Paschen, F.* *Götting. Nachr.* (1895) 11 pp.; *Astrophys. J.* 2 (1895) 202-211.  
*Pickering, F. C.* *Astrophys. J.* 7 (1898) 139; *Harv. Observ. Cir.* 21 (1897).  
*Poincaré, H.* *Naturw. Rundsch.* 13 (1898) 413-417.  
*Report (Ninth) on Solar Radiation.* Rept. Brit. Assoc. (1893) 144-146.  
*Riccò e Tacchini.* *Mem. Spettr. Ital.* 25 (1896) 321.  
*Rizzo, G. B.* *Mem. Spettr. Ital.* 20 (1891) 10 pp.; Beibl. (1891) 645.  
 ——. *Mem. Spettr. Ital.* 26 (1897) 79-93.  
*Rowland, H. A.* *Chem. News* 59 (1889) 124-125; Beibl. (1889) 316.  
 ——. Rept. Brit. Assoc. (1890) 751.  
 ——. (*Solar Spectrum Tables.*) *Astrophys. J.* 1 (1895) to 6 (1897).

- Runge, C., and Paschen, F.* *Astrophys. J.* 4 (1896) 317-319; Beibl (1897) 518.
- Sartorio, G.* *Mem. Spettr. Ital.* 24 (1895) 133.
- Saville, R.* *Ann chim phys* (6) 25 (1892) 567-574; Beibl. (1891) 645.
- Scheiner, F.* *Astron. Nachr.* 137 (1895) 229-232; Beibl. (1896) 108.
- Schmidt, L.* *Diss. Stuttgart*, 1891, Beibl. (1892) 152.
- *Sirius n F* 28 (1895) 217-226; Beibl. (1896) 127.
- Schulz, F.* *Astron. Nachr.* 118 (1889) No. 2817; 119 (1889) 2847, Beibl. (1889) 505-507.
- Schuster, A.* *C. R.* 118 (1894) 137-138.—See *Duner, C.-R.* 117 (1893) 1056-1059.
- Sidgreaves, W.* *Astron. and Astrophys.* 12 (1893) 826-834.
- Simon, O.* Beibl. (1892) 152.
- *Verh. Ges. deutsch. Naturf. u. Aerzte* II, 1 (1895) 85.
- Smyth, C. P.* *Rept. Brit. Assoc.* (1891) 147; Beibl. (1892) 573, 610.
- Spee, E.* *Mem. Spettr. Ital.* 28 (1899) 131-132.
- Stas, F. S.* *Mem. Acad. Belg.* 49 (1891) 47 pp.; Beibl. (1892) 152.
- Stefanini, A.* *Nuovo Cim.* (4) 3 (1896) 306-307.
- Stokes, G. G.* *Rept. Brit. Assoc.* (1889) 40-41; (1892) 158-165.
- Stratonoff, W.* *Mem. Spettr. Ital.* 25 (1896) 87-89.
- Straubel, R.* *Astron. Nachr.* 139 (1896) 225-240; Beibl. (1897) 334.
- Stumpé, O.* *Naturwiss. Rundsch.* 11 (1896) 441-443.
- Sykora, I.* *Mem. Spettr. Ital.* 23 (1894) 201-207.
- Tacchini, P.* *Mem. Spettr. Ital.* (1894); *Astron. and Astrophys.* 13 (1894) 503.
- *Mem. Spettr. Ital.* 24 (1895) 158-162, 25 (1896) 27-30, 151-161, 167-172, 235-240; 26 (1897) 38-43, 94-99; 27 (1898) 1-9, 67-71, 109-112, 162-166, 28 (1899) 27-30.
- Timiriaseff, C.* *Naturwiss. Rundsch.* 4 (1889) 646-647.
- Trowbridge, F.* *Amer. J. Sci.* (4) 1 (1896) 329-333; *Phil. Mag.* (6) 14 (1896) 450-454.
- and *Hutchins, C.* *Proc. Amer. Acad.* 23 (1887) 9 pp., Beibl. (1888) 352.
- *Proc. Amer. Acad.* 23 (1887) 10-13; Beibl. (1888) 356.
- Widmark, O.* *Öfvers. af Vet. Akad. Stockholm Förh.* 54 (1897) 287-309.
- Wilczynski, E. F.* *Astrophys. J.* 1 (1895) 112-126; 2 (1895) 69-74; Beibl. (1896) 32.
- *Astrophys. J.* 4 (1896) 101-105, 310.
- Wilson, W. E.* *Astron. and Astrophys.* (1892) 46-50.
- and *Gray, P. L.* *Phil. Trans.* 185 A (1894) 361-396.



## SOLAR ATMOSPHERE.

- Brester, A., Jr.* *Astron. and Astrophys.* 13 (1894) 849-856.—See  
*Oppolzer, Astrophys. J.* 1 (1895) 260-262.  
*Deslandres, H.* *C.-R.* 113 (1891) 307-310; 114 (1892) 276-277; 119  
 (1894) 457-460; 120 (1895) 1112-1114, 1331-1333.  
*Dunér, N. C.* *Astron. and Astrophys.* 13 (1894) 215-218.  
*Hale, G. E.* *C.-R.* 114 (1892) 1406-1407.  
*Jewell, L. E., J. F. Mohler, and W. J. Humphreys.* *Astrophys. J.* 3  
 (1896) 138-140.  
*Oppolzer, E. von.* *Astrophys. J.* 1 (1895) 260-262.—See *Astron. and*  
*Astrophys.* 13 (1894) 218.

## SOLAR CHROMOSPHERE

- Deslandres, H.* *C.-R.* 118 (1894) 842-844.  
 ——. *Bull. astron.* 11 (1894) 425-426.  
 ——. *Knowledge* 17 (1894) 277; 18 (1895) 12, 59-60.  
*Evershed, J.* *Knowledge* 18 (1895) 39.  
*Hale, G. E.* *Astrophys. J.* (1895) 384-385; *Beibl.* (1896) 199.  
 ——. *Astrophys. J.* 6 (1897) 412-414.  
*Heen, P. de.* *Bull. Acad. Belg.* (3) 33 (1897) 205-210, 800-802; *C.-R.*  
 (1897) 459-460.  
*Janssen, J.* *C.-R.* 116 (1893) 456-458.  
*Jewell, L. E.* *Astrophys. J.* 8 (1898) 119-120.  
*Paige, C.* *Bull. Acad. roy. Belg.* (3) 67 (1897) 802-803.—See same  
 vol., 205 and 800.  
*Young, C. A.* *Nature* 45 (1891) 28; *Beibl.* (1893) 830.  
*Zenger, C. V.* *C.-R.* 121 (1895) 406-408.

## SOLAR CORONA.

- Baume-Pluvinel, A. de la.* *Bull. Soc. astron. France* (1896) 228-234.  
*Bélopolsky.* *Astron. Nachr.* 124 (1890) 183-186; *Beibl.* (1891) 207.  
*Bigelow, F. L.* *Amer. J. Sci.* (3) 40 (1890) 343-358; *Beibl.* (1891)  
 107.  
 ——. *Amer. J. Sci.* (3) 41 (1891) 505-507; *Beibl.* (1891) 644.  
 ——. *Amer. J. Sci.* (3) 42 (1891) 1-11; *Beibl.* (1891) 717.  
 ——. *Nature* 41 (1890) 138; 42 (1890) 138; *Beibl.* (1890) 787.  
*Campbell, W. W.* *Astrophys. J.* 10 (1899) 186-192.  
*Corrigan, S. J.* *Astron. and Astrophys.* (1892) 362-367.  
*Deslandres, H.* *C.-R.* 116 (1893) 126-128, 1184-1187; 117 (1893)  
 1053-1056; 120 (1895) 707-710.

- Ebert, H.* Astron. and Astrophys. 12 (1893) 804-810; Beibl. (1894) 339.  
*Evershed, J.* Nature 48 (1893) 268; Beibl. (1894) 563.  
*Hale, G. E.* C.-R. 116 (1893) 865-866.  
 — — —. Astron. and Astrophys. 13 (1894) 662-688.  
 — — —. Astrophys. J. 1 (1895) 318-334; Beibl. (1896) 32.  
*Janssen, J.* C.-R. 116 (1893) 456-457; 117 (1893) 77-80.  
*Lockyer, Sir J. N.* Proc. Roy. Soc. 64 (1899) 168-170; Nature 59 (1898) 279-280.  
*Lynn, W. T.* Observ. 19 (1896) 332-334.  
*McConnel, J. C.* Phil. Mag. (5) 29 (1890) 167-173.  
*Ramsay, W.* Proc. Roy. Soc. 58 (1895) 81-89.  
*Riccò, A.* Mem. Spettr. Ital. 24 (1895) 21-30; Beibl. (1895) 428.  
*Riccò e Tacchini.* Mem. Spettr. Ital. 25 (1896).  
 — — —. Mem. Spettr. Ital. 25 (1896) 127-134.  
*Schaeberle, J. M., and Lockyer, J. N.* Nature 44 (1891) 300-301.  
*Tacchini, P.* Mem. Spettr. Ital. 24 (1895) 319, 320.  
*Todd, D. P.* Astrophys. J. 8 (1898) 253.  
*Young, C. A.* Astrophys. J. 6 (1897) 155.

## SOLAR ECLIPSES.

- Abbe, C.* Nature 38 (1889) 519-521; Beibl. (1890) 38.  
*Abney, W. de W., and T. E. Thorpe.* Proc. Roy. Soc. 46 (1889) 354.  
 — — —. Phil. Trans. 186 (1896) Part I; Astrophys. J. (1896) 375.  
*Davis, H. S.* New York Acad. Sci. Trans. 16 (1896) 376.  
*Deslandres, H.* C.-R. 116 (1893) 1108-1110; Beibl. (1894) 671.  
 — — —. C.-R. 120 (1895) 707-710; 123 (1896) 978-981.  
*Exner, K.* Astron. Nachr. (1887) 321-324; Beibl. (1887) 671.  
*Hills, E. H.* Proc. Roy. Soc. 56 (1894) 20-36.  
 — — —. Mon. Not. 56 (1896) 258-284.  
*Janssen, J.* C.-R. 110 (1890) 1353-1355.  
*Kobold, H.* Astron. Nachr. 40 (1896) 225-227.  
*Lockyer, J. N.* Proc. Roy. Soc. 60 (1896) 17-19; Phil. Trans. 187 (1896) 551-618.  
*Nagamvala, K. D.* Astrophys. J. 8 (1898) 121.  
*Riccò, A.* Mem. Spettr. Ital. 24 (1895) 12-14.  
 — — — e *Mascari, A.* Mem. Spettr. Ital. 24 (1895) 127.  
*Schaeberle, J. M., R. H. Tucker, C. D. Perrine, and R. C. Aitken.* Pub. A. S. P. (1895) 287.

- Schaeberle, J. M.* *Conz*. Lick Observ. Contrib. No. 4 (1895)  
126 pp.; Beibl. (1896) 138.  
*Vary, F. W.* *Astrophys. J.* 2 (1892) 293-305; Beibl. (1896) 699.  
*Weber, L.* *Astron. Nachr.* 1887, 17-22; Beibl. (1888) 663.

## SOLAR PHOTOGRAPHY.

- Hale, G. E.* *Astron. and Astrophys.* (1892) 2, 105, 407-417, 603-604.  
— — —. *Astron. and Astrophys.* (1892) 811-815; *Chem. News* 67 (1893) 4-5.  
— — —. *Astrophys. J.* 2 (1895) 1.  
*Nature* (Editorial). *Nature* 44 (1891) 391-392.  
*Smyth, C. P.* *Rept. Brit. Assoc.* (1890) 750-751; Beibl. (1892) 279.  
*Toll, D. P.* *Astrophys. J.* 5 (1897) 313-324.  
*Zenger, Ch.* *Compt. rend.* 109 (1889) 434-436; Beibl. (1890) 37.

## SOLAR PROMINENCES.

- Bélopolsky, A.* *Mem. Spettr. Ital.* 25 (1896) 23-26.  
*Coit, J. B.* *Astron. Nachr.* 16 (1896) 67-69.  
*De Landres, H.* *C.-R.* 120 (1895) 417-420.—See Poincaré, *ibid.* 420-421.  
— — —. *C.-R.* 124 (1897) 171-173.  
*Duner, N. C.* *Oefvers. Vet. Akad. Forh. Stockholm* 47 (1890) 17-21; Beibl. (1890) 621.  
— — —. *Acta Sci. Upsal.* 14 (1891) 1-78; Beibl. (1892) 430.  
*Fanyti, J.* *C.-R.* 109 (1889) 132-133.  
— — —. *Astron. Nachr.* 126 (1890) 113-116.  
— — —. *C.-R.* 113 (1891) 310-313; Beibl. (1891) 107.  
— — —. *Astron. and Astrophys.* 13 (1894) 122-128.  
— — —. *Astrophys. J.* (1895) 212-215.  
— — —. *Mem. Spettr. Ital.* 25 (1896) 47-52; Beibl. (1897) 340.  
— — —. *C.-R.* 121 (1895) 931-933; Beibl. (1896) 699.  
— — —. *C.-R.* 122 (1896) 72-80.  
*Fizeau.* *C.-R.* 113 (1891) 353-356; Beibl. (1892) 154.  
*Flamache, A.* *Bull. Soc. Belge d'Astron.* 1 (1896) 83-91.  
*Hale, G. E.* *Technol. Quart.* 3 (1891) 310-316; Beibl. (1891) 516.  
— — —. *Amer. J. Sci.* (3) 42 (1891) 459-467; Beibl. (1893) 126.  
— — —. *C.-R.* 116 (1893) 170-173.  
— — —. *Astron. and Astrophys.* 13 (1894) 113-122; Beibl. (18-94) 672.

- Hale, G. E.* (Cont'd). *Astrophys. J.* (1895) 433-434.  
 — — — *Astrophys. J.* 3 (1896) 374-387.  
*Kononowitsch, A., Zucknowitsch, and Orbinsky, J.* *Astrophys. J.*  
 3 (1896) 241.  
*Mascari, A.* *Mem. Spettr. Ital.* 24 (1895) 61-79; 25 (1896) 55-56,  
 187-204.  
*Renton, J.* *Nature* 54 (1896) 317.  
*Riccio, A.* *Astron. Nachr.* 22 (1889) 259-262; *Beibl.* (1891) 106.  
 — — — *Astron. Nachr.* 124 (1890) 255-256.  
 — — — *Mem. Spettr. Ital.* 20 (1891) 5; *Beibl.* (1892) 153.  
*Sartorio, G. W.* *Mem. Spettr. Ital.* 25 (1896) 65-81.  
*Schmidt, A.* *Sirius* 23 (1895) 97-109; *Beibl.* (1895) 890.  
*Sykora, J.* *Mem. Spettr. Ital.* 25 (1896) 10-12, 173-179; 27 (1898)  
 33-39; 28 (1899) 11-18.  
*Tacchini, P.* *Mem. Spettr. Ital.* 23 (1894); 24 (1895) 15-17, 129-  
 130, 25 (1896) 59-61, 107-112, 151-154, 243-248, 26 (1897)  
 25-28, 29-30, 65-70, 27 (1898) 49, 113-114, 159-161; 28 (1899)  
 9-10, 91-95, 137-140, 153-158.  
*Townsend, J. S.* *Jour. B. A. A.* 5 (1895) 153.  
 — — — *Jour. B. A. A.* 5 (1895) 468.  
*Trouvelot, E. L.* *C.-R.* 105 (1887) 610-612; 113 (1891) 437-438.  
*Wilsing, Ch. V.* *Bull. Soc. Belge d'Astron.* 1 (1896) 8-12.  
*Wilsing, J.* *Astron. Nachr.* (1888) 311-316.

SOLAR ROTATION OBSERVED WITH THE SPECTROSCOPE.

- Faye, H.* *C.-R.* 111 (1890) 77-92.  
*Harzer, P.* *Astron. Nachr.* 142 (1896) 23-25, 253-255.  
*Knopf, O.* *Diss., Jena.* 1893, 44 pp.; *Beibl.* (1893) 930; (1894) 670.  
*Schmidt, A.* *Sirius* 19 (1891) 170-179; *Beibl.* (1892) 152.  
*Stoney, G. J.* *Rept. Brit. Assoc.* (1891) 573-574; *Beibl.* (1893) 931.  
*Stratonoff, W.* *Astron. Nachr.* 137 (1895) 165-168.  
*Vicare, E.* *Bull. Soc. Philom.* (8) 2 (1889-1890) 159-170; *Beibl.*  
 (1891) 34.  
*Wilczynski, E. J.* *Astron. Nachr.* 142 (1896) 133-135.  
*Wilsing, J.* *Astron. Nachr.* 137 (1895) 385-387.  
*Wolfer, A.* *Naturf. Ges. Zurich* (1896) 100-145.

SUN-SPOTS.

- Living, G. D., and Dewar, J.* *Rept. Brit. Assoc.* (1883) 455.  
*Lockyer, J. N.* *Proc. Roy. Soc.* 57 (1895) 199; *Nature* 57 (1895)  
 448-449.

- Mazzoni, A.* *Mem. Spectr. Ital.* 24 (1895) 97-102; 25 (1896) 147-153; 26 (1897) 45-50; 27 (1898) 135-152; 28 (1899) 31-35. III.
- Oppolzer, E. von.* *Sitzb. Wiener Akad.* 102 II (1893) 375-413; *Beibl.* (1894) 91.
- Pizzani, A.* *Mem. Spectr. Ital.* 24 (1894) 3 pp.
- Sprenger, G.* *Astron. Nachr.* 125 (1890) 215, 515.
- Tassinari, P.* *Mem. Spectr. Ital.* 24 (1895) 15-20, 103-108; 27 (1898) 45-48, 109-112, 162-166; 28 (1899) 1-8, 59-72, 141.
- Wilson, W. E.* *Proc. Roy. Soc.* 55 (1894) 246-251; *Beibl.* (1894) 955.
- — —. *Mon. Not.* 55 (1895) 457-462.

## TRANS.

- Ernst, E. E.* *Astron. J.* 16 (1896) 73-75.
- Ernst, L.* *Astron. Nachr.* 142 (1896) 37-42.
- Huggins, W.* *C.-R.* 108 (1889) 1228-1229; *Beibl.* (1889) 688.
- — and *Mrs. Huggins.* *Proc. Roy. Soc.* 46 (1889) 231-233; *Beibl.* (1889) 949.
- Keller, J. E.* *Astron. Nachr.* 122 (1889) 401-404; *Beibl.* (1890) 119, 1100.
- Lockyer, J. N.* *C.-R.* 108 (1889) 1140-1151; *Beibl.* (1889) 688.

## URSAE MAJORIS.

- Pickering, E. C.* *Amer. J. Sci.* 3 39 (1890) 46; *Beibl.* (1890) 515.

## VARIABLES.

- Anderson, T. D.* *Astron. Nachr.* 139 (1895) 27-29, 118, 269; 141 (1896) 104, 419; 142 (1897) 159.
- Backhouse, T. W.* *Observ.* 18 (1895) 94; 19 (1896) 160-161.
- Bailey, S. I.* *Astrophys. J.* 10 (1899) 255-260.
- Ball, L. de.* *Astron. Nachr.* 137 (1895) 73-74.
- Becker, E.* *Astron. Nachr.* 139 (1895) 41.
- Bélopolsky, A.* *Astron. and Astrophys.* 13 (1894) 130-136.
- —. *Bull. Acad. St. Petersburg* (1894) 267-306; *Astron. Nachr.* 136 (1894) 281-284; 140 (1896) 17-21.
- —. *Astron. Nachr.* 140 (1896) 21-22.
- —. *Astrophys. J.* 6 (1897) 328-337.
- —. *Astrophys. J.* 6 (1897) 393-399.
- Berberich, A.* *Naturwiss. Rundsch.* 14 (1899) 465-466, 481-484.
- Brester, A.* *Nature* 53 (1896) 248-249.
- Brown, E., and W. Noble.* *Observ.* 18 (1895) 200-202.

- Campbell, W. W.* Astron. J. 16 (1896) 24.  
 ———. Astrophys. J. 9 (1899) 86.  
 ———. Astrophys. J. 9 (1899) 310.  
 ———. Astrophys. J. 9 (1899) 311.  
 ———. Astrophys. J. 10 (1899) 178-179.  
 ———. Astrophys. J. 10 (1899) 180-183.  
*Chandler, S. C.* Astron. J. 14 (1894) 125.  
 ———. Astron. J. 15 (1895) 181-182.  
 ———. Astron. J. 16 (1896) 71-72, 107-108.  
*Clarke, A. M.* Observ. 19 (1896) 115-116; 20 (1897) 52-55.  
*Copeland, R.* Astron. Nachr. 139 (1895) 115-117.  
*Deslandres, H. C.-R.* 119 (1894) 1251-1254; 120 (1895) 1252.  
*Dumesnil, C.-R.* 122 (1896) 768-769.  
*Dunér, N. C.* Astrophys. J. (1895) 285-294; Beibl. (1896) 40.  
 ———. Astrophys. J. 3 (1896) 348-350; Astron. Nachr. 140 (1896) 261-263.  
*Eddie, L. A.* Astrophys. J. 3 (1896) 227-228.  
*Editor of the Astron. J.* 14 (1894) 144; 16 (1895) 16; 17 (1897) 64.  
*Espin, T. E.* Astrophys. J. 10 (1899) 160-172.  
*Flanery, D.* Knowledge 18 (1895) 182-183.  
*Fleming, W.* Astrophys. J. 2 (1895) 198-201; Beibl. (1896) 371.  
 ———. Astrophys. J. 1 (1895) 411-415.  
 ———. Astrophys. J. 3 (1896) 296-302.  
 ———. Astrophys. J. 8 (1898) 233.  
*Fowler, A.* Nature 38 (1888) 492-493; Beibl. (1889) 885.  
*Frost, E. B.* Astrophys. J. 10 (1899) 184-185.  
*Gill, W. J.* Astron. J. 16 (1896) 63.  
 ———. Astron. J. 17 (1897) 94-95.  
*Glaschnapp, S.* Compt. rend. Soc. astron. Russe 1 (1896) 153-178.  
*Hagen, J.* Astron. Nachr. 141 (1896) 94-98.  
*Holtschek, J.* Astron. Nachr. 140 (1896) 171-173.  
*Inness, R. T. A.* Astron. J. 17 (1897) 95-96.  
*Kapeleyn, J. C.* Astron. Nachr. 142 (1896) 75-77.  
*Keeler, J. E.* Astrophys. J. 1 (1895) 262.  
*Kruess, G.* Astron. Nachr. 141 (1896) 203-205.  
*Lockyer, J. N.* Proc. Roy. Soc. 59 (1895) 9, 101-106.  
*McClean, F.* Mon. Not. 57 (1896) 6-8.  
*Markwich, E. E.* Observ. (1890) 178-179; Beibl. (1890) 983.  
 ———. Eng. Mech. 62 (1895) 289, 425-426; Astron. Nachr. 138 (1895) 213-214. Mon. Not. 55 (1895) 338-341; 56 (1896) 381-388.





- West, R. H. *Astron. J.* 16 (1896) 23.  
 — — *Astron. J.* 16 (1896) 85-86, 211; 17 (1896) 3, 54, 88.  
 Williams, A. S. *Astron. Nachr.* 143 (1897) 26-27.  
 Wolf, M. *Astron. Nachr.* 142 (1897) 373.  
 Yendell, P. S. *Vierteljahrsschr. d. astron. Ges.* 30 (1895) 258-280.  
 — — *Astron. J.* 14 (1895) 183 184; 15 (1895) 72, 78-79, 92-96, 104, 153-155, 157, 173-174, 191 192; 16 (1896) 31-32, 40, 46-47, 54, 56, 64, 78, 110, 117, 120, 173, 194, 202; 17 (1896) 12, 67, 79.

## VENUS.

- Anvers, A. *Astron. Nachr.* 134 (1894) 39 362.  
 Barnard, E. E. *Astron. Nachr.* 120 (1891) 295-296.  
 — — *Astrophys. J.* 5 (1897) 299 304.  
 Brenner, L. *Astron. Nachr.* 139 (1896) 25-27, 313 318.  
 — — *Observ.* 19 (1896) 161.  
 — — *Astron. Nachr.* 140 (1896) 175.  
 Ceruti, V. *Astron. Nachr.* 138 (1895) 366; 139 (1896) 263-266.  
 Holden, E. S. *Pub. A. S. Pac.* 8 (1896) 181 183.  
 Mascari, A. *Astron. Nachr.* 139 (1896) 257-263, 303.  
 Perrotin, J. *C.-R.* 122 (1896) 1038-1042.  
 Peyra, D. *Mem. Spettr. Ital.* 25 (1896) 102.  
 Russell, H. N. *Astrophys. J.* 9 (1899) 284 299.  
 Tacchini, P. *Mem. Spettr. Ital.* 25 (1896) 93-99.  
 Trouvelot, E. L. *Bull. Soc. astron. France* (3) 2 (1892) 87 pp.

## VIRGO.

- Backhouse, T. W. *Jour. B. A. A.* 5 (1895) 307. (Zodiacal Light.)  
 Belopolsky, A. *Bull. Acad. St. Petersburg* (5) 8 (1898) 141-158, in Russian.  
 Vogel, H. C. *Sitzb. Berliner Akad.* (1890) 401-402.  
 — — *Astron. Nachr.* 125 (1891) 305-316.

## ATMOSPHERIC SPECTRA.

- Abney, W. de W. *Phil. Trans.* 178 II (1887) 251-283; 184 (1893) 1-42.  
 Arndt, Th. *Ann. Phys. n. F.* 58 (1896) 171-204.  
 Arrhenius, Sv. *Phil. Mag.* (5) 41 (1896) 237-276; *Beibl.* (1896) 979.  
 — — *Bih. k. Svensk. Akad. Handl.* (1897) 102 pp.; *Beibl.* (1897) 976.

- Baily, E. C.* Nature 58 (1898) 545.  
*Bartoli, A.* Riv. Sci. industr. 26 (1894) 141-147.  
*Becker, L.* Edinburgh Trans. 36 I (1890) 99-210.  
*Benedicenti.* Atti Accad. Lincei 5 (1896) 404-410.  
*Bidwell, S.* Nature 41 (1890) 213; Beibl. (1890) 807.  
*Brennan, W.* Proc. Roy. Soc. 49 (1891) 4-11, 255-280; Beibl. (1891) 337.  
*Bunte, H.* J. f. Gasbel. (1891) 11 pp.  
*Campbell, W. W.* Astrophys. J. 1 (1895) 85.  
*Chappuis, J., et Ch. Rivière.* Compt. rend. 102 (1886) 1461.  
*Comstock, G. C.* Astron. Nachr. 139 (1895) 135-138.  
*Cornu, A.* Nature 53 (1896) 588-592.  
*Crova, A.* C.-R. 108 (1889) 119-122.  
*Duclaux, E.* Smithsonian Contrib. 29 (1896) 48 pp.; Beibl. (1897) 983-985.  
*Hartley, W. N.* Nature 38 (1888) 474-477.  
 — — —. Proc. Roy. Soc. 57 (1895) 293-296.  
*Hasselberg, B.* Oefvers. k. Vet. Akad. Vorh. 49 (1892) 441-449; Beibl. (1893) 915.  
*Hausdorff, F.* Diss., Leipzig, 1895, 83 pp.; Beibl. (1895) 888.  
*Hepperger, J. von.* Sitzb. Wiener Akad. 105 IIa (1895) 173-227.  
*Higgs, G.* Rept. Brit. Assoc. (1890) 760.  
*Huggins, W.* Astrophys. J. 1 (1895) 103-195.  
*Hutchins, C. C.* Amer. J. Sci. (3) 43 (1892) 357-365.  
*Janssen, J.* C.-R. 107 (1888) 672-677.  
*Jewell, L. E.* Astrophys. J. 4 (1896) 324-342.  
 — — —. Astrophys. J. 5 (1897) 279-281.  
*Johnstone, J. G.* Dublin Trans. 6 (1897) 128. 305-328.  
*Kayser, H., und C. Runge.* Preuss. Akad. Abhandl. (1893) 161-191.  
*Keeler, J. E.* Astrophys. J. 8 (1898) 113.  
*Kuenan, J. P., and W. W. Randall.* Proc. Roy. Soc. 59 (1896) 60-66.  
*Leduc, A.* C.-R. 123 (1896) 805-807.  
*Limb, C.* C.-R. 121 (1895) 887-888.  
*Liveing, G. D., and J. Dewar.* Phil. Mag. (5) 36 (1893) 328-331.  
 — — —. Phil. Mag. (5) 37 (1894) 235-249; Beibl. (1895) 60.  
 — — —. Phil. Mag. (5) 39 (1895) 268-272; Beibl. (1896) 31, 93.  
*Lommel, E. von.* Abhandl. d. Bayer. Akad. 19 II (1897) 1-60; Beibl. (1898) 568.  
*Mach, E., fils.* Soc. franç. de phys. (1893) 283.  
*Mach, L.* Wiener Anzeigen (1897) 209.  
*Manson, M.* Pub. A. S. Pac. 8 (1896) 47-64.

- Maurer, J. Repert. d. Phys. 25 (1889) 642-654.
- Mueller, G., und P. Kempf. Pub. Obs. Potsdam 11 (1898) 211 pp.; Beibl. (1898) 776.
- Neovius, O. Bih. Svensk. Akad. Handl. 17 I (1891) 69 pp.; Beibl. (1893) 563.
- Olzowski, K. Sitzb. Wiener Akad. 95 II (1887) 257-261.
- Puccini, A. Gazz. chim. Ital. 28 (1898) 169-181.
- Plummer, W. E. Nature 55 (1896) 235-236.
- Ramsay, W. London. Macmillan, 1896, 240 pp., with portraits. (Gases.)
- and M. W. Travers. Proc. Roy. Soc. 63 (1898) 405-408.
- , —. Proc. Roy. Soc. 62 (1898) 225-232; Beibl. (1898) 217.
- Rayleigh, Lord. Phil. Mag. (5) 29 (1890) 173-180.
- , —. Phil. Mag. (5) 47 (1899) 375-385; Beibl. (1899) 424.
- Riccò, A. Rend. Accad. Roma 6 (1890) 13-17.
- , —. Mem. Spettr. Ital. 25 (1896) 8 pp.; Beibl. (1896) 978.
- Rydberg, J. R. Oefvers. k. Svensk. Akad. Forh. 50 (1893) 693-697; Beibl. (1895) 486.
- Schaeberle, J. M. Lick Obs. Contrib. No. 3 (1893) 89 pp.; Beibl. (1893) 650.
- Schmidt, A. Sirius 23 (1895) 97-109; Beibl. (1895) 890.
- Schumann, V. Wiener Anzeigen (1895) 24-30, 121.
- Seeliger, H. Sitzb. Muenchener Akad. 21 (1891) 239-246, 247-272; Beibl. (1894) 78.
- Sella, A., e Q. Majorana. Atti Accad. Lincei 5 (1896) 323-327, 389-392.
- Sherman, O. T. Amer. J. Sci. (3) 33 (1887) 126-129; Beibl. (1888) 50.
- Simonsen, E. A. Diss., Kiel, 1892, 36 pp.
- Soret, Ch. Arch. de Genève (4) 4 (1897) 530-540; Beibl. (1898) 563.
- Soret, J. L. Arch. de Genève 20 (1888) 591-593; Beibl. (1889) 495.
- Spring, W. Bull. Acad. Belgique 36 (1898) 504-519; Arch. de Genève 7 (1899) 225-240.
- , —. Bull. Acad. Belgique 37 (1899) 441-446.
- Stoney, G. Fohnstone. Dublin Trans. (2) 6 (1897) 305-328; Astrophys. J. 7 (1898) 25-55.
- Sundell, A. F. Phil. Mag. (5) 24 (1887) 98.
- Very, F. W. Astrophys. J. 2 (1895) 237.
- Vicentini, G. Rend. Accad. Roma (5) 1 (1892) 13-17, 143-149, 235-241.
- Vogel, H. W. Photogr. Mittheil. 29 (1892) 73-75, 138-141, 156-159, 172-175.

*Walter, A.* Leipzig: Teubner, 1898, 74 pp.

*Wiener, Ch.* Beibl. (1897) 32.

*Wilson, C. T. R.* Cambridge Phil. Proc. 9 (1898) 392-393; Beibl. (1898) 562.

#### AURORA SPECTRA.

*Abbe, C.* Proc. Amer. Phil. Soc. (1898); Beibl. (1899) 178.

*Anon.* Nature 60 (1899) 130-133.

*Antoniadi, E. M.* Jour. B. A. A. 5 (1894) 106-107.

*Berthelot, C.-R.* 120 (1895) 662.

*Campbell, W. W.* Astrophys. J. 2 (1895) 162.

*Clerke, Miss A.* Observ. (1889) 363-394.

*Corrigan, S. J.* Astron. and Astrophys. (1892) 362-367.

*Editor of Nature.* Vol. 51 (1895) 517.

*Hazen, H. A.* Amer. Metaphys. J. 11 (1894) 221-229.

*Herschel, A. S.* Nature 51 (1895) 246-247.

*Huggins, W.* Proc. Roy. Soc. 45 (1889) 430-436.

*Kirk, E. B.* Observ. (1886) 311.

*Kuznetzov, V.* Bull. Acad. St. Petersb. (5) 8 (1898) 159-162. In Russian.

*Lockyer, J. N.* Nature 36 (1887) 358-359; Beibl. (1888) 663.

— — —. Proc. Roy. Soc. 47 (1890) 28-39.

*Paulsen, N.* Oefvers. k. Danske Forh. (1894) 148-168; Beibl. (1895) 427.

*Pickering, E. C.* Astrophys. J. 7 (1898) 292; Harvard Observ. Cir. 28 (1898).

*Runge, C.* Nature 59 (1898) 29.

*Wendt, G.* Naturwiss. Wochenschr. 12 (1897) 469-477.

*Wood, W. H.* Sci. Amer., Supp. 40 (1895) 165-169.

#### AZO COLORS.

*Goldschmidt, H., und Bass, F.* Ber. chem. Ges. 30 (1897) 2075-2094.

*Grebe, C. H.* Ztsch. physikal. Chem. 10 (1892) 673-698; Beibl. (1893) 336.

#### BALLOONS, SPECTRA FROM.

*Bezold, W. von.* Verh. d. physikal. Ges. Berlin 15 (1896) 45-60; Beibl. (1897) 416.

#### BARIUM SPECTRA.

*Baldwin, C. W.* Phys. Rev. 3 (1895-1896) 452.

*Eder, J. M., und E. Valenta.* Denkschr. Wiener Akad. 60 II (1893) 467-476.

- Humphreys, W. J.* *Astrophys. J.* 6 (1897) 169-232.  
*Villard, P.* *Éclairage electr* 16 (1896) 313-314.  
*Wadsworth, F. L. O.* *Astrophys. J.* 4 (1896) 308.

## BECQUEREL RAYS

- Borgmann, J. J.* *C. R.* 124 (1897) 895-896.  
*McKissick, A. F.* *Sci. Amer., Suppl.* 43 (1897) No. 17542.  
*Stewart, O. M.* *Phys. Rev.* 6 (1898) 239-251.

## BENZINE.

- Berthelot, C.-R.* 120 (1895) 1386-1390.  
*Heumann, K., und Rey, H.* *Ber chem Ges.* 22 (1889) 3001-3004

## BERYLLIUM.

- Humphreys, W. J.* *Astrophys. J.* 6 (1897) 169-232.  
*Rowland, H. A., and R. R. Tatnall.* *Astrophys. J.* 1 (1895) 14-17,  
 149-153.

## BISMUTH.

- Egoroff, N., et Georgiewski, N.* *C.-R.* 124 (1897) 949-951.  
*Humphreys, W. J.* *Astrophys. J.* 6 (1897) 169-232.  
*Kayser, H., und Runge, C.* *Abhandl. d. Berliner Akad.* (1893) 20.  
*Klatt, V., und Lenard, Ph.* *Ann. Phys. n. F.* 38 (1889) 90-107.

## BLACK BODIES, SPECTRA OF.

- Lebon, G.* *C.-R.* 122 (1896) 188-190, 233, 386, 462, 522, 1054; 18  
 (1899) 297-300.  
*Lummer, O.* *Naturwiss. Rundsch.* 11 (1896) 65, 81, 93; *Beibl.* (1896)  
 688.  
 — — und *E. Pringsheim.* *Ann. Phys.* 63 (1897) 395.  
 — —. *Ztsch. f. Instrum.* 18 (1898) 144; *Beibl.* (1898) 665.  
 — —. *Verh. deutsch. physikal. Ges.* 1 (1899) 23-41.  
*Mendenhall, C. E., and F. A. Saunders.* *Phil. Mag.* (5) 44 (1897)  
 136  
 — —. *Johns Hopkins Univ. Cir.* (1898) 55; *Beibl.* (1898) 770.  
*Nieuenglowski, G. H.* *C. R.* 122 (1896) 232.  
*Paschen, F. O.* *Astrophys. J.* 10 (1899) 40-57.  
*Very, F. W.* *Astrophys. J.* 10 (1899) 208.

## BLOOD SPECTRA.

- Gräbe, H.* *Diss., Dorpat,* 1892, *Beibl.* (1896) 127

- Hénocque, A.* Paris: Masson, 1895. 200 pp.  
*Huejner, G.* Archiv f. Physiol. (1890) 1-2, 28-30; (1894) 130-176.  
*Linossier, G.* Chem. Centralbl. (1889) 816.  
*Sczelkow.* Archiv f. Physiol. 41 (1888) 373.  
*Zaleski, J.* Ber. chem. Ges. 30 (1897) 965-967.

## BLUE RAYS.

- Kohl, F. G.* Naturwiss. Rundsch. 12 (1897) 425; Beibl. (1897) 983.

## BOLOMETRY.

- Abbot, C. G.* Astrophys. J. 8 (1898) 250-252.  
*Angström, K.* K. Ges. Wiss. Upsala, 9. April, 1892, 45 pp.  
 ——. Oefvers. Vet. Akad. Forh. 45 (1888) 379-383; Beibl. (1889) 307.  
 ——. Ann. Phys. n. F. 48 (1893) 493  
 ——. Ann. Phys. n. F. 52 (1894) 509.  
 ——. Nova Acta Sci. Upsala, 1895.  
*Child, C. D., and O. M. Stewart.* Phys. Rev. 4 (1897) 502-504.  
*Donath, Br.* Ann. Phys. n. F. 58 (1896) 609-661.  
*Edelmann, M. Th.* Electrotech. Ztsch. 15 (1894) 81-82; Beibl. (1894) 749.  
*Hale, G. E.* Astrophys. J. 1 (1895) 162-166.  
*Hallock, W.* Sci. 2 (1895) 174-178.  
*Helmholtz, R. von.* Verh. d. physikal. Ges. Berlin 7 (1888) 73; Beibl. (1889) 882.  
*Hupe, A.* Programm d. Realschule, Charlottenburg, Ostern, 1894, 46 pp.  
*Julius, W. H.* Arch. néerland. des Sci. 22 (1887) 310, 383; Beibl. (1889) 307.  
 ——. Verh. k. Akad. Amsterdam I, No. 1, 1892; Beibl. (1893) 34.  
*Krüss, H.* Jour. f. Gasbel. u. Wasservers., 1895.  
*Kurlbaum, F.* Ann. Phys. n. F. 61 (1897) 417-435.  
*Langley, S. P.* Phil. Mag. (5) 26 (1888) 505; Jahresb. (1888) 435; Am. J. Sci. 36 (1888) 397.  
 ——. Astron. and Astrophys. 13 (1893) 41-44; Beibl. (1894) 749.  
 ——. Amer. J. Sci. (4) 5 (1898) 241-245; Beibl. (1898) 399.  
 ——. Smithsonian Institution Astrophysical Observ. Repts. 1888-1899.  
*Lummer, O., und F. Kurlbaum.* Ann. Phys. n. F. 46 (1892) 204.

- Lummer, O., und F. Kurlbaum* Sitzb. Berliner Akad. 11 (1894) 229-238.  
 — — und *Pringsheim*. Ztsch. Instrum. 18 (1898) 144; Beibl. (1898) 665.  
*Paschen, F.* Ann. Phys. n. F. 48 (1893) 272; 53 (1894) 287-300; Astrophys. J. 10 (1899) 40-57.  
*Raid, H. F.* Amer. J. Sci. (3) 35 (1888) 160-166; Beibl. (1888) 337.  
*Rubens, H.* Verh. d. physikal. Ges. Berlin 9 (1890) 27-31.  
*Sharp, C. H., and W. R. Turnbull.* Phys. Rev. 2 (1894) 1-35; Beibl. (1895) 170. 883  
*Wadsworth, F. L. O.* Astrophys. J. 5 (1897) 268-276.

## BORAX.

- Eder, J. M., und Valenta, E.* Denkschr. d. Wiener Akad. 60 (1893) 307-311, 467-476.  
*Ghira, A.* Rend. Accad. Lincei (5) 2 (1893) 312-319; Beibl. (1893) 1047.  
*Humphreys, W. J.* Astrophys. J. 6 (1897) 169-232.  
*Rowland, H. A., and R. R. Tatnall.* Astrophys. J. 1 (1895) 14, 149; Beibl. (1895) 422.  
*Sabatier, P.* C.-R. 112 (1891) 862-864.

## BROADENING OF LINES.

- Eder, J. M., und E. Valenta.* Denkschr. d. Wiener Akad. (1898) 11 pp.  
*Galitsin, B.* Bull. Acad. St. Petersb. 5 II (1895) 397-417; Beibl. (1895) 78-99.  
*Lockyer, J. N.* Nature 51 (1895) 448-449; Beibl. (1896) 33.  
 — — — Proc. Roy. Soc. 61 (1897) 441-444; Beibl. (1897) 975.  
*Lommel, E. von.* Ann. Phys. n. F. 56 (1895) 741-745.  
*Mascari, A.* Mem. Spett. Ital. 27 (1898) 81-90.  
*Mebius, C. A.* Oefvers. k. Vet. Akad. Forh. Stockholm 55 (1898) 485-495; Beibl. (1899) 419.  
*Mihelson, A. A.* Astrophys. J. 2 (1895) 251-263.  
*St. Dunstan, A., M. E. Rice, and C. A. Krauss.* Amer. J. Sci. (4) 3 (1897) 472-475.  
*Scheiner, J.* Astron. Nachr. 133 (1893) 73-80; Beibl. (1894) 104.  
*Voigt, W.* Ann. Phys. n. F. 68 (1899) 604-606.  
*Wanner, H.* Ann. Phys. n. F. 68 (1899) 143-144.

## BROMINE.

- Brauns, R.* Neues Jahrb. f. Min. Geol. u. Paleont. 2 (1891) 12-20.



- Camichel, Ch.* C.-R. 117 (1893) 307-309; Beibl. (1893) 1058.  
*Eder, J. M., und Valenta, E.* Wiener Anzeiger (1899) 225.  
*Gramont, A. de.* Ann. chim. phys. (7) 10 (1897) 213-234.  
*Hasselberg, B.* Svensk. Akad. Handl. 24 (1893) 53 pp.; Beibl. (1894) 339.  
*Herzig, J.* Sitzb. Wiener Akad. 107 IIb (1898) 111-115.  
*Kastle, J. H.* Amer. Chem. Jour. 21 (1899) 398-413; Beibl. (1899) 782.  
*Lea, M. C.* Amer. J. Sci. (3) 33 (1887) 349-364; Beibl. (1888) 50.  
*Liebermann, C., und Hartmann, A.* Ber. Chem. Ges. 26 (1893) 829-833.  
*Sabatier, P.* C.-R. 118 (1894) 980-982, 1042-1043; Beibl. (1894) 757, 838.  
 ——. C.-R. 118 (1894) 1260-1263; Beibl. (1894) 1048.  
*Schottlaender, P.* Liebig's Ann. 240 (1887) 346; Jahresb. (1887) 605.  
*Schramm, J., und J. Zakrzewski.* Monatsh. f. Chem. 8 (1887) 299-309; Beibl. (1888) 51.  
*Schumann, V.* Jahresb. f. Photogr. (1893) 160-165; Beibl. (1893) 1030.  
*Vogel, E.* Photogr. Mittheil. 28 (1891) 139-140; Beibl. (1892) 281.  
*Wiedemann, E., und Schmidt, G. C.* Jahrb. f. Photogr. u. Reprod. (1896) 15.  
*Wood, R. W.* Phil. Mag. (5) 41 (1896) 423-431; Beibl. (1896) 776.

## BUTTER SPECTRA.

- Ellinger, H. O. G.* J. prakt. Chem. 44 (1891) 157-159; Beibl. (1891) 712.  
*Violette, C.* C.-R. 111 (1890) 348; Beibl. (1891) 34.

## CADMIUM.

- Ames, J. S.* Phil. Mag. (5) 30 (1890) 33-48; Beibl. (1890) 1097-1099.  
*Eder, J. M., und E. Valenta.* Denkschr. d. Wiener Akad. (1894) 347-364.  
*Grünwald, A.* Sitzb. Wiener. Akad. 97 II (1888) 967-1045; Beibl. (1889) 309.  
*Hamy, M.* C.-R. 126 (1898) 231-234; Beibl. (1898) 153.  
*Humphreys, W. J.* Astrophys. J. 6 (1897) 169-232.  
*Jones, A. C.* Diss., Erlangen, 1896. 29 pp.; Beibl. (1897) 413.  
*Living, G. D., and Dcwar, J.* Proc. Roy. Soc. 43 (1887-1888) 430.

*Michelson, A. A.* Compt. rend. 116 (1893) 790-794. Beibl. (1894) 625.

*Muynck, R. de.* Ann. Phys. n. F. 53 (1894) 559-563.

## CAESIUM.

*Humphreys, W. F.* Astrophys. J. 6 (1897) 169-232.

## CALCIUM

*Baldwin, C. W.* Phys. Rev. 3 (1895-1896) 451.

*Eder, J. M.* Wiener Anzeiger (1892) 252-253; Beibl. (1893) 444

— — — und *E. Valenta.* Denkschr. d. Wiener Akad. 60 II (1893) 467-476.

— — —. Denkschr. d. Wiener Akad. (1898) 11 pp.; Beibl. (1899) 250.

*Eppler, A.* Ztsch. f. Krystall. u. Min. 30 (1898) 118-176.

*Foley, A. L.* Phys. Rev. 5 (1897) 143.

*Huggins, Sir William, and Lady Huggins.* Astrophys. J. 6 (1896) 322-327.

— — —. Proc. Roy. Soc. 61 (1897) 433-441.

*Humphreys, W. F.* Astrophys. J. 6 (1897) 169-232.

*Lommel, E.* Ann. Phys. n. F. 30 (1887) 47; Jahresb. (1887) 354

*Merritt, E.* Phys. Rev. 2 (1895) 424-442; Ann. Phys. n. F. 55 (1895) 49-64.

*Nichols, E. L., and Crehore, M. L.* Phys. Rev. 2 (1894) 161-170; Beibl. (1895) 565.

*Smith* Rev. scientif. 52 (1893) 410; Beibl. (1893) 1070

## CAMPHOR

*Haller, A., et Muller, P. Th.* C.-R. 128 (1899) 1370-1373

*Kipping, Fr. St., and W. F. Pope.* J. Chem. Soc. 71 (1897) 956-962.

*Wallach, O.* Göttinger Nachr. (1896) 63-73; Beibl. (1897) 732.

## CARBON ,

*Ångström, K.* Öfvers. Vet. Akad. Forh. Stockholm 46 (1889) 539-557

*Barbier, Ph., et L. Roux.* C.-R. 111 (1890) 180-183, 235-236, 112 (1891) 582-584

*Bosanquet, R. H. M.* Phil. Mag. (5) 34 (1892) 120-130, 355-370; Beibl. (1893) 573.

*Cohen, E.* Ztsch. f. physikal. Chem. 28 (1899) 145-153.

- Conrady, E.* Ztsch. f. physikal. Chem. 3 (1889) 210.
- Costa, T.* Riv. Sci. Industr. 24 (1892) 104-109; Beibl. (1892) 424.
- Crookes, W.* Chem. News 72 (1895) 99; Beibl. (1895) 531.
- Deslandres, H.* C.-R. 106 (1888) 842-856.
- —. C.-R. 112 (1891) 661-663.
- —. J. de phys. (2) 10 (1891) 276-281.
- —. C.-R. 120 (1895) 1259-1260; Beibl. (1895) 694.
- Donath, Br.* Ann. Phys. n. F. 58 (1896) 609-661.
- Dufour, Ch., et Brunner.* Naturwiss. Rundsch. 10 (1895) 608; Beibl. (1896) 127.
- Eder, J. M.* Monatsh. f. Chem. 11 (1890) 151-153; Beibl. (1890) 780. (Swan's Spectrum.)
- — — und *E. Valenta.* Denkschr. d. Wiener Akad. 60 II (1893) 241-262.
- Engelmann, Th. W.* Arch. néerland. 22 (1887) 1-57.
- Exner, F., und Haschek, E.* Sitzb. Wiener Akad. 106 II (1897) 1127-1152.
- Fievez, Ch.* Bull. Acad. Belgique 14 (1887) 100-107; Jahresb. (1887) 347.
- —. Ann. Observat. Bruxelles (1888) 10 pp.; Beibl. (1888) 246.
- Foley, A. S.* Phys. Rev. 5 (1897) 145.
- Gennari, G.* Rend. Accad. Roma (5) 3 (1894) 123-129; Beibl. (1894) 666.
- —. Gazz. chim. Ital. 24 (1894) 468-474; Beibl. (1894) 907.
- Ghira, A.* Rend. Accad. Roma 3 (1894) 391-393.
- Gladstone, J. H., and W. H. Perkin.* Rept. Brit. Assoc. (1889) 515.
- — — and G. Rept. Brit. Assoc. (1890) 772.
- — — Rept. Brit. Assoc. (1892) 679.
- Gramont, A. de.* Bull. Soc. chim. (3) (1898) 19-20; Chem. News 78 (1898) 270.
- Gruner, P.* Diss., Zurich, 1893; Beibl. (1893) 924.
- Grünwald, A.* Wiener Anzeiger (1887) 287; Sitzb. Wiener Akad. 96 II (1887) 1154-1216.
- Hale, G. E.* Astrophys. J. 6 (1897) 412-414.
- Hartley, W. N.* J. Chem. Soc. 51 (1887) 58-61; Beibl. (1887) 437.
- — —. J. Chem. Soc. 51 (1887) 152-200; Beibl. (1887) 537.
- — —. J. Chem. Soc. 53 (1888) 641-663; Beibl. (1888) 791.
- — —. Proc. Roy. Soc. 54 (1894) 344-349; Beibl. (1894) 1046.
- — —. Proc. Roy. Soc. 61 (1897) 217-219.
- — — and *J. J. Dobbie.* J. Chem. Soc. 73 (1898) 598-606; Beibl. (1898) 668.

- Hartley, W. N., and J. J. Dobbie. J. Chem. Soc. 74 (1899) 640-661.  
Hartman, L. W. Phys. Rev. 9 (1899) 176-189.  
Huggins, Sir W. Nature 55 (1897) 316 317.  
Humphreys, W. J. Astrophys. J. 6 (1897) 169-232.  
Kayser, H., und Runge, C. Ann. Phys. n. F. 38 (1889) 80-90.  
Knops, C. Liebig's Ann. 248 (1888) 175-231.  
Kobbe, F. Chem. Centralbl. (4) 2 (1890) 617.  
Konig, W. Verh. deutsch. Naturf. u. Aerzte (1898) 68; Beibl. (1898) 563.  
Kostanecki, St. von. Ber. chem. Ges. 24 (1891) 150-156.  
Krafft, F. Ber. chem. Ges. 21 (1888) 2261-2271, 3180-3188; Beibl. (1889) 19, 83.  
Kurlbaum, F. Ann. Phys. n. F. 61 (1897) 417-435.  
Leicester, J. Chem. News 66 (1892) 295.  
Lewes, V. B. Chem. News 65 (1892) 79, 99, 125; Beibl. (1893) 747.  
— — — Proc. Roy. Soc. 57 (1895) 450; Beibl. (1895) 692.  
Liebermann, C. Ber. chem. Ges. 21 (1888) 2527.  
Lockyer, J. N. Proc. Roy. Soc. 47 (1890) 39-41; Beibl. (1890) 516.  
— — — Nature 55 (1897) 304, 341; Beibl. (1898) 155.  
Mayberry, F., and E. J. Hudson. Amer. Chem. J. 19 (1897) 482-484.  
Meyer, L., jr. Ber. chem. Ges. 25 (1892) 3121-3123.  
— — — Ztsch. physikal. Chem. (3) 11 (1893) 426-428.  
Nasini e Anderlini. Rend. Accad. Roma (5) 3 (1894) 22, 49; Beibl. (1894) 665.  
Nichols, E. L. Phys. Rev. 2 (1895) 267.  
Oechelhauser, W. von. Beibl. (1893) 446.  
Paschen, F. Ann. Phys. n. F. 53 (1894) 334-336.  
Pawlewski, Br. Ber. chem. Ges. 31 (1898) 1693.  
Pflueger, A. Ann. Phys. n. F. 65 (1898) 214-224.  
Prytz, K., und H. Holst. Oefvers. k. Danske Vid. Forh. (1894) 12 pp.  
Ransohoff, M. Diss., Berlin 1896. 32 pp; Beibl. (1897) 737.  
Rubens, H., und Askinass, E. Ann. Phys. n. F. 64 (1898) 1, 584-601.  
Setschenow, T. Mem. Acad. St. Petersb. 34 (1886) 1.  
Smith, A. P. Chem. News 61 (1890) 292; Jahresb. (1890) 384.  
Smithells, A. J. Chem. Soc. 67 68 (1895) 1049-1062, 1149-1163.  
Beibl. (1896) 367.  
Spaulden, E. Photogr. Mittheil. 32 (1895) 6-11.  
Thiele, T. N. Astrophys. J. 8 (1898) 1-27.  
Traube, J. Ber. chem. Ges. 30 (1897) 38-43.  
Trowbridge, J., and Hutchins, C. C. Phil. Mag. (3) 24 (1887) 310; Beibl. (1888) 355.

- Troubridge, J.* (*Cont'd*). Amer. J. Sci. (4) 1 (1896) 329-333; Phil. Mag. (6) 14 (1896) 450-454.
- Verschaffelt, J.* Bull. Acad. Roy. Belg. (1894) 49-84; Beibl. (1894) 833.
- Vogel, H. W.* Sitzb. Berliner Akad. 21 (1888); Verh. d. physikal. Berlin (1888) 523-528.
- Vogel, O.* Ztschr. anorg. Chem. 5 (1893) 42-62; Beibl. (1894) 84.

## CERIUM.

- Bettendorff, A.* Liebig's Ann. 256 (1890) 159; 263 (1891) 164; 270 (1892) 376.
- Broekelmann, K.* Diss., Erlangen 1891; Beibl. (1891) 515.
- Humphreys, W. J.* Astrophys. J. 6 (1897) 169-232.
- Lohse, O.* Abhandl. d. Berliner Akad. (1897); Astrophys. J. 6 (1897) 95-118.
- Lumière, A. und L.* Photogr. Mittheil. 30 (1893) 139.
- Schottlaender, P.* Ber. chem. Ges. 25 (1892) 378-395, 569-599.
- Strohecker, J. R.* J. prakt. Chem. (2) 33 (1886) 132-140; Jahresb. (1886) 407.

## CHLORINE.

- Angström, K., och Palmer.* Oefvers. Vet. Akad. Stockholm (1893) 389; Beibl. (1894) 87.
- Backelandt, L.* Bull. Acad. Belg. (3) 11 (1886) 194-199; Jahresb. (1886) 316.
- Brauns, R.* Neues Jahrb. f. Min. Geol. u. Pal. 2 (1891) 12-20.
- Conroy, Sir J.* Proc. Roy. Soc. 64 (1899) 308-318.
- Dussaud, F.* C.-R. 113 (1891) 291; Beibl. (1892) 26.
- Eder, J. M., und E. Valenta.* Wiener Anzeiger (1898) 252-253.
- Engel.* Bull. Soc. chim. Paris (3) 6 (1891) 239-251.
- Gramont, A. de.* Ann. chim. phys. (7) 10 (1897) 213-234.
- Guntz.* C.-R. 113 (1891) 72-75.
- Herschel, A. S.* Nature 41 (1890) 513-514; Beibl. (1890) 782.
- Klimenko, E., und H. Pckatoros.* Chem. Centralbl. (4) 1 (1890) 570.
- Kowalewski, W. A.* J. russ. phys. chem. Ges. 29 (1897) 217-222; Beibl. (1897) 968.
- Kreutz, F.* Beibl. (1895) 636.
- Lea, M. C.* Amer. J. Sci. (3) 33 (1887) 349-364; Beibl. (1888) 50.
- Lemoine, G.* Ann. chim. phys. (7) 6 (1895) 433-540.
- Magnanini.* Rend. Accad. Roma 5 (1889) 908-912.

- Mayberry, F., and E. J. Hudson. Amer. J. Sci. (4) 19 (1897) 482-484.  
 Michaelis, A. Ber. chem. Ges. 20 (1887) 2488-2492.  
 Pedler, A. J. Chem. Soc. 57 (1890) 613-625; Beibl. (1890) 1102.  
 Politzinc, A. Bull. Soc. chim. Paris (3) 6 (1891) 264-266.  
 Richardson, A. Phil. Mag. (5) 32 (1891) 277-284; Beibl. (1892) 537.  
 Silet, G. C=R 110 (1890) 282-283; Beibl. (1890) 511.—See A. P. Smith, Chem. News (1890) 292.  
 Schmitt, F. Ztsch. f. physikal. Chem. 5 (1890) 349.  
 Smith, A. P. Chem. News 61 (1890) 292.—See G. Salet above.  
 Staats, G. Ber. chem. Ges. 20 (1887) 2322; 21 (1888) 2199.  
 Stortenbeker, W. Versl. Akad. Amsterdam (1892) 160-163; Beibl. (1894) 758.  
 Strohecker, J. R. J. prakt. Chem. (2) 33 (1886) 132-140, Ber. chem. Ges. (1886) 1099.  
 Wiedemann, E., und G. C. Schmidt. Jahrb. f. Photogr. u. Reprod. (1896) 15.  
 Wild, J., und J. Harker. Electrician 38 (1897) 690; Beibl. (1897) 590.

## CHLOROPHYLL.

- Étard, L. C-R. 123 (1896) 824-828; 124 (1897) 1351-1354; Beibl. (1897) 32, 740.  
 Hansen, Ad. Beibl. (1890) 901.  
 Hartley, W. N. J. Chem. Soc. 59-60 (1891) 106-124, Beibl. (1891) 280.  
 Schunck, C. A. Proc. Roy. Soc. 63 (1893) 389-396, Beibl. (1898) 776.  
 ———. Proc. Roy. Soc. 65 (1899) 177-186.  
 ——— and Marchlewski. Proc. Roy. Soc. 59 (1896) 235.  
 Tschirch, A. Photogr. Mittheil. (1896); Beibl. (1897) 130.  
 Wollheim. Photogr. Mittheil. 25 (1888) 113-114, Beibl. (1888) 856.

## CHROMIUM.

- Boisbaudran, F. Lecoq de. C.-R. 104 (1887) 1584; Beibl. (1887) 786.  
 ———. C.-R. 104 (1887) 1288; 105 (1887) 452; 106 (1888) 451-455, 468-471, 490, 1781; Beibl. (1888) 476; (1889) 19.  
 Étard, A. C-R. 120 (1895) 1057-1060, Beibl. (1895) 568.  
 Exner, F., und Haschek, E. Sitzb. Wiener Akad. 106 (1897) 1127-1152.  
 Hasselberg, B. K. Svensk. Akad. Handl. 26 (1894) 33 pp.; Beibl. (1894) 837.

- Humphreys, W. J.* *Astrophys. J.* 6 (1897) 169-232.  
*Lapraik, W.* *J. prakt. Chem.* (2) 47 (1893) 305-342; *Beibl.* (1893) 650.  
*Magnanini, G., e T. Bentivoglio.* *Rend. Accad. Roma* (1893) 17; *Beibl.* (1893) 926.  
 ——. *Gazz. chim. Ital.* 25 (1895) 373-379; *Beibl.* (1896) 695.  
*Moissan, H.* *C.-R.* 119 (1894) 185-191.  
*Monti, V.* *Nuovo Cim.* (4) 3 (1896) 212-216.  
*Recoura, A.* *C.-R.* 102 (1886) 515, 865, 921, *Jahresb.* (1886) 423.  
 ——. *C.-R.* 129 (1899) 288-291.  
*Sabatier, P.* *Ann. de Toulouse* 1 D (1887) 11 pp.; *Beibl.* (1888) 194.  
*Schunck, C. A.* *Chem. News* 51 (1885) 152 Abs.; *Jahresb.* (1885) 323.  
*Soret, Ch., A. Borel, et E. Dumont.* *Arch. de Genève* (3) 3 (1897) 376-382.  
*Whitney, W. R.* *Ztsch. physikal. Chem.* 20 (1896) 40-68.

## CLEVEITE.

- Clève, P. F.* *C.-R.* 120 (1895) 834-835; *Beibl.* (1895) 568.  
*Crookes, W.* *Chem. News* 71 (1895) 151; *Beibl.* (1895) 634.  
*Deslandres, H.* *C.-R.* 120 (1895) 1112-1114; *Beibl.* (1895) 568.  
 ——. *C.-R.* 120 (1895) 1331-1333; *Beibl.* (1895) 693.  
*Hagenbach, A.* *Ann. Phys. n. F.* 60 (1896) 124-133.  
*Hale, G. E.* *Astrophys. J.* 2 (1895) 76.  
*Lockyer, J. N.* *Proc. Roy. Soc.* 62 (1897) 52-67.  
*Nature (Editor of).* *Nature* 53 (1896) 448-449.  
*Palmieri, L.* *Rend. Accad. Napoli* (3) 3 (1895) 121; *Beibl.* (1896) 531.  
*Runge, C., und F. Paschen.* *Sitzb. Berliner Akad.* 34 (1895) 759; *Beibl.* (1895) 885.  
*Rydberg, J. R.* *Ann. Phys. n. F.* 58 (1896) 674-679.  
*Vogel, H. C.* *Sitzb. Berliner Akad.* (1895) 947-958; *Beibl.* (1896) 372.

## COBALT.

- Aubel, E. van.* *Bull. Acad. roy. Belg.* (2) 11 (1886) 408-414; *Beibl.* (1887) 435.  
*Conroy, J.* *Chem. News* 63 (1891) 105-106; *Beibl.* (1891) 516.  
*Engel.* *Bull. Soc. chim. Paris* (3) 6 (1891) 239-251.  
*Étard, A.* *C.-R.* 113 (1891) 699-701; 120 (1895) 1057-1060; *Beibl.* (1895) 568.  
*Hasselberg, B.* *K. Svensk. Akad. Handl.* (1896) 44 pp.; *Beibl.* (1896) 692.



- Humphreys, W. J.* *Astrophys. J.* 6 (1897) 169-232.  
*Kallir, J.* *Ann. Phys. n. F.* 31 (1887) 1015.  
*Kelrman, F.* *Ber. chem. Ges.* 19 (1886) 3101; *Jahresb.* (1886) 412.  
 — und *N. Pickersgill.* *Ber. chem. Ges.* 24 (1891) 2324-2326.  
*Living, G. D., and J. Dewar.* *Phil. Trans.* 179 1 (1888) 231-256;  
*Beibl.* (1889) 380.  
*Moissan, H., et Ch. Moureau.* *C.-R.* 122 (1896) 1240-1243.  
*Politzinc, A.* *Bull. Soc. chim. Paris* (3) 6 (1891) 264-266.  
*Russell, W. J., and Orsman, W. J.* *Chem. News* 59 (1889) 93-94;  
*Beibl.* (1896) 535.  
*Stortenbecker, W.* *Versl. Akad. Amsterdam* (1892) 160-163; *Beibl.*  
 (1894) 758.

## COCAINE.

- Autrik, O.* *Ber. chem. Ges.* 20 (1887) 310-322.

## COERULIN.

- Higgs, G.* *Proc. Roy. Soc.* 49 (1891) 345-346; *Beibl.* (1891) 518.

## COLOR.

- Abney, W. de W.* *Inst. Gt. Brit.* Feb. 25, 1887, 11 pp.; *Beibl.* (1888)  
 350.  
 — and *E. R. Festing.* *Phil. Trans.* 177 (1886) 423-456;  
*Beibl.* (1888) 340.  
 — — — *Proc. Roy. Soc.* 44 (1888) 237-239; *Beibl.* (1889) 679;  
*Phil. Trans.* (1888) 547-570.  
 — — — *Proc. Roy. Soc.* 49 (1891) 227-233; 50 (1891) 369-372;  
*Beibl.* (1891) 512.  
 — — — and *E. R. Festing.* *Phil. Trans.* 183 (1892) 521-566.  
 — — — *Proc. Roy. Soc.* 56 (1894) 221-229; *Beibl.* (1895) 179.  
*Acroyd, W.* *Chem. News* 65 (1892) 205; *Beibl.* (1892) 534.  
 — — — *Chem. News* 67 (1893) 27, 64, 111, 147; *Beibl.* (1893) 445;  
 (1894) 756.  
*Armstrong, H. E.* *Chem. News* 65 (1892) 285; 66 (1892) 143, 155,  
 288, 297, 311; 67 (1893) 143; *Beibl.* (1893) 206; (1894) 756.  
*Auvers, A.* *Astron. Nachr.* 123 (1889) 97-104; *Beibl.* (1890) 787.  
*Bailey, W.* *Phil. Mag.* (5) 33 (1892) 496-503.  
*Bolas, T.* *Photo. News* 41 (1897) 295.  
*Bonacini, C.* *Mem. Spettr. Ital.* 23 (1894) 146-154.  
*Brodhun, E.* *Ztschr. d. Sinnesorgane* (3) 2-3 (1892) 97-117, *Beibl.*  
 (1892) 674.

- Govi, G.* Rend. Accad. Lincei 4 (1888) 572-577; Beibl. (1889) 502.  
*Hartley, W. N.* J. Chem. Soc. 63 (1893) 243-256; Beibl. (1894) 756  
*Helmholtz, H. von.* Sitzb. Berliner Akad. (1891) 1071-1083.  
*Krüss, G. und H.* Leipzig: Voss, 1891, 291 pp.; Beibl. (1891) 236.  
*Lea, M. Carey.* Amer. J. Sci. (3) 49 (1895) 357-374; Beibl. (1895) 886; (1896) 695.  
*Lippmann, G.* C.-R. 115 (1892) 575.  
 ———. Proc. Roy. Soc. 60 (1896) 10-13; Beibl. (1897) 418.  
*Magnanini, G.* Rend. Accad. Lincei (5) 4 (1895) 60-63; Beibl. (1895) 887.  
*Marey.* Soc. franç. de phys. (1893) 5.  
*Neuhauss, R.* Verh. d. physikal. Ges. Berlin 17 (1898) 94-96; Beibl. (1898) 844.  
*Newth, G. S.* Nature 47 (1892) 55; Beibl. (1893) 335.  
*Nichols, E. L., and B. W. Snow.* Phil. Mag. (5) 32 (1891) 401-424; Beibl. (1892) 361.  
*Ostwald, W.* Ztsch. physikal. Chem. 9 (1892) 579-603; Beibl. (1892) 534.  
*Perner, J. M.* Sitzb. Wiener Akad. 106 IIa (1897) 135-235.  
*Rayleigh, Lord.* Edinburgh Trans. 33 (1887) 157-170; Beibl. (1888) 198.  
*Valenta, E.* Verh. deutsch. Naturf. u. Aerzte 11, 1 (1895) 78-79.  
*Vogel, H. W.* Verh. d. physikal. Ges. Berlin 10 (1891) 33-35; Beibl. (1891) 560.  
*Waugh, W. R.* Observ. 18 (1895) 234.  
*Zenker, W.* Jahrb. d. Photogr. 7 (1893) 114-121; Beibl. (1894) 568.

## COLUMBIUM.

- Humphreys, W. J.* Astrophys. J. 6 (1897) 169-232.

## CONTINUOUS SPECTRA.

- Koevesligethy, R. von.* Ber. aus Ungarn 4 (1885-1886) 9-10; 5 (1886-1887) 20-28.  
*Lommel, E. von.* Ann. Phys. n. F. 56 (1895) 741-745.  
*Michelson, W.* J. russ. phys. chem. Ges. (6) 21 (1889) 87-103; Beibl. (1890) 277.  
*Snow, B. W.* Phys. Rev. 1 (1893) 290-298; Beibl. (1894) 997.  
*Tomlinson, H. J., and K. Pearson.* Phil. Mag. (5) 46 (1898) 306-312.

## COPPER.

- Baldwin, C. W.* Phys. Rev. 3 (1895) 454.

- Boisbaudran, F. Lecoq de.* C.-R. 106 (1888) 1386-1387.  
 ———. C.-R. 124 (1897) 1288-1290, 1419-1421; Beibl. (1897) 735.  
*Cardani, P.* Atti Accad. Roma 4 (1895) 242-250.  
*Carrara, G., e Minozzi, A.* Gazz. chim. Ital. 27 (1897) 455-467; Beibl. (1898) 560.  
*Daugbigny, H., et Pecharde, E.* C.-R. 115 (1892) 171-174.  
*Eder, J. M., und E. Valenta.* Denkschr. d. Wiener Akad. 63 (1896) 47 pp.; Beibl. (1896) 366.  
*Egoroff, N., et N. Giorgiewski.* C.-R. 124 (1897) 949-951.  
*Ewan, T.* Phil. Mag. (5) 33 (1892) 317-342; Beibl. (1893) 37.  
*Herschel, A. S.* Nature 41 (1890) 513-514; Beibl. (1890) 782.  
*Humphreys, W. J.* Astrophys. J. 6 (1897) 169-232.  
*Kayser, H., u C. Runge.* Ann. Phys. n. F. 46 (1892) 225.  
 ———. Astrophys. J. 1 (1895) 84.  
*Klatt, V., und Ph. Lenard.* Ann. phys. n. F. 38 (1889) 90-107.  
*Rydberg, J. R.* Astrophys. J. 6 (1897) 239-243; Beibl. (1898) 153.  
*Sabatier, P.* C.-R. 118 (1894) 980, 1042, 1144; Beibl. (1894) 757, 838.  
 ———. C.-R. 118 (1894) 1260-1263; Beibl. (1894) 1048.  
*Salet, G.* C.-R. 110 (1890) 282-283; Beibl. (1890) 511.  
*Smithells, A.* Phil. Mag. (5) 39 (1895) 122-134; Beibl. (1895) 243.  
*Wegschneider, R.* Sitzb. Wiener Akad. 106 (1897) 5255.

## CORONIUM.

- Nasini, Anderlini, and Salvadori.* Chem. News 78 (1898) 43.

## CRYSTALS.

- Anderson, A.* Cambridge Proc. 9 (1896) 195-198.  
*Aschkinass, E.* Verh. d. physikal. Ges. Berlin 17 (1898) 101-105.  
*Bandrowski, E.* Ztschr. physikal. Chem. 15 (1894) 323; 17 (1895) 234; Beibl. (1895) 495.  
*Basso, G.* Nuovo Cim. 5 (1886) 210-226.  
 ———. Atti Accad. Torino 28 (1892) 89-94.  
*Beaulard, F.* C.-R. 110 (1890) 1063-1066; 111 (1890) 173-176.  
*Becquerel, H.* Ann. chim. phys. (6) 14 (1888) 170-257.  
*Berthelot.* Ann. chim. phys. (7) 7 (1896) 58-94.  
*Borel, G. A.* Arch. de Genève (3) 34 (1895) 134-158, 230-259; Beibl. (1895) 790.  
*Boumann, Z. P.* Zittingsversl. Akad. Amsterdam (1896) 438-442.  
*Brauns, K.* Neues Jahrb. f. Min. Geol. u. Paleontol. 2 (1891) 12-20.

- Camichel, C.* Soc. franç. de phys. (1895) 50-56; Beibl. (1896) 129.
- Carvallo, E.* C.-R. 114 (1892) 288-291.
- . Soc. franç. de phys. (1892) 4; C.-R. 114 (1892) 661; Beibl. (1892) 602.
- . Soc. franç. de phys. (1893) 290-299; Beibl. (1893) 576.
- . Ann. chim. phys. (8) 7 (1898) 375.
- . C.-R. 126 (1898) 728-731; Beibl. (1899) 31.
- Czapski, S.* Beibl. (1890) 993.
- Dongier, R.* Soc. franç. de phys. (1896) 310-311.
- . Thèse, Paris, Série A, 297, 63-141, 1898; Beibl. (1899) 183-185.
- Drude, P.* Ztschr. f. Kryst. 13 (1887) 567-575; Beibl. (1888) 359.
- Dussaud, F.* C.-R. 113 (1891) 291.
- Eppler, A.* Ztschr. f. Kryst. u. Min. 30 (1898) 118-176.
- Fabry, Ch.* C.-R. 120 (1895) 314-317; Beibl. (1895) 637.
- Fock, A.* Ztsch. f. Kryst. u. Min. 17 (1889) 368-383, 578-591; 20 (1892) 76-84, 332-344; 21 (1893) 29-42; 23 (1895) 334-349.
- Fowle, F. E.* Amer. J. Sci. (4) 2 (1896) 255-258.
- Giesel, F.* Ber. chem. Ges. 30 (1897) 156-158; Beibl. (1897) 337.
- Gleichen, A.* Ztschr. f. Math. u. Phys. 34 (1889) 161-176; Beibl. (1890) 34.
- . Ztsch. f. physikal. Unterr. 2 (1889) 229-232; Beibl. (1890) 499.
- Goldhammer, D.* J. russ. phys. chem. Ges. 18 (1886) 239-267.
- Gramont, A. de.* C.-R. 121 (1895) 121-123.
- Grosse, W.* Ztschr. f. Instrum. 13 (1893) 6-13; Beibl. (1894) 183.
- Hasselberg, B.* Ann. Phys. n. F. 27 (1886) 415.
- Herschel, A. S.* Rept. Brit. Assoc. (1885) 942-944; Beibl. (1888) 336.
- Hess, W.* Ann. Phys. n. F. 36 (1889) 264-270.
- Horn, G.* Diss., Göttingen 1898; Beibl. (1899) 183.
- Hupe, A.* Progr., Realschule Charlottenburg, Ostern 1894, 46 pp.
- Hussell, A.* Diss., Muenchen 1891, 13 pp.
- Julius, V. A.* Arch. néerland. 29 (1896) 454-466; Beibl. (1896) 539.
- Ketteler, E.* Ann. Phys. n. F. 56 (1895) 56-77, 540-555.
- Klein, H. J.* Sitzb. Berliner Akad. (1890) 703-733.
- Lépinay, J. Macé de.* J. de phys. 6 (1887) 190-201; Beibl. (1887) 786.
- . J. de phys. (3) 1 (1892) 23-31.
- Liebis, Th.* Götting. Nachr. (1893) 265-266; Beibl. (1894) 575.
- Liveing, G. D.* Cambridge Phil. Trans. 15 I (1890) 19 pp.
- . Nature 44 (1891) 156-160.
- Lommel, E.* Sitzb. Muenchener Akad. 19 (1889) 317-328.

- Mallard et Le Chatellier.* Ann. chim. phys. (6) 6 (1895) 90-115.  
*Mascart et Bouasse.* C.-R. 111 (1890) 83-84; Beibl. (1890) 905.  
*Merritt, E.* Phys. Rev. 2 (1895) 424-442; Ann. Phys. n. F. 55 (1895) 49-64.  
*Mesnil, G.* C.-R. 120 (1895) 261-263.  
*Morcan, G.* C.-R. 120 (1895) 258, 602-605.  
*Nichols, E. F.* Sitzb. Berliner Akad. (1896) 1183-1196; Ann. Phys. n. F. 60 (1897) 401-417.  
 — — — Phys. Rev. 4 (1897) 297-313.  
 — — — and *B. W. Snow* Phil. Mag. (5) 33 (1892) 379 381; Beibl. (1892) 608.  
*Perrot, F. L.* Arch. de Genève (1891) 26-70; Beibl. (1891) 357.  
*Pope, W. J.* Ztsch. f. Min. u. Kryst. 25 (1896) 567-571; Beibl. (1896) 373.  
 — — — J. Chem. Soc. 69 (1896) 1530-1536; Ztsch. f. Kryst. u. Min. 28 (1897) 113 128.  
*Quesneville, G.* C.-R. 121 (1895) 522-525; 121 (1895) 1136 1139.  
*Rayleigh, Lord.* Proc. Roy. Inst. March 12, 1889, 3 pp.  
*Rubens, H., and E. L. Nichols.* Phys. Rev. 5 (1897) 157.  
*Stewart, O. M.* Phys. Rev. 4 (1896) 433-457.  
*Stober, F.* Bull. Acad. Roy. Belg. (3) 30 (1895) 520-539.  
*Tutton, A. E.* Proc. Roy. Soc. 54 (1894) 111 113; Ztsch. f. Kryst. u. Min. 24 (1895) 455.  
*Voigt, W.* Götting. Nachr. (1896) 252-254, 560-562; Beibl. (1897) 1.  
*Wasasterna, L.* Oefvers. Finska Vet. Forh. 31 (1888) 167-177; Beibl. (1891) 111.

## CYANOGEN.

- Dixon, H. B., E. H. Strange, and E. Graham.* J. Chem. Soc. 69-70 (1896) 759-774.  
*Foley, A. L.* Phys. Rev. 5 (1897) 147.  
*Hartley, W. N.* Chem. News 79 (1899) 101.  
*Lang, M. Victor von* Sitzb. Wiener Akad. 84 II (1881) 361; Jahresb. (1881) 130.  
*Pflüger, A.* Ann. Phys. n. F. 65 (1898) 214-224; Astrophys. J. 9 (1899) 187.  
*Smithells, A., and F. Dent.* J. Chem. Soc. 55-56 (1894) 603-611; Beibl. (1895) 60.  
*Vogel, H. W.* Sitzb. Berliner Akad. 21 (1888); Verh. d. physikal. Ges. (1888) 523-528.  
*Wood, R. W.* Phil. Mag. (5) 46 (1898) 380-386; Astrophys. J. 9. (1899) 188, Abs

## D LINES.

- Hale, G. E.* *Astrophys. J.* 2 (1895) 165, 384-385; *Beibl.* (1896) 199.  
*Huggins, W.* *Astron. Nachr.* 138 (1895) 229; *Beibl.* (1896) 199.  
*Mohler, J. F., and Jewell, L. E.* *Astrophys. J.* (1896) 351-355.  
*Palmer, A. D., Jr.* *Amer. J. Sci.* (3) 50 (1895) 357-358; *Beibl.* (1896) 197.  
*Ramsay, W.* *Proc. Roy. Soc.* 58 (1895) 81-89.  
*Riccò, A.* *Astron. Nachr.* 138 (1895) 287-288; *Astrophys. J.* 2 (1895) 236.  
*Ross, W. A.* *Chem. News* 34 (1876) 212, 226, 237; *Jahresb.* (1876) 145.  
*Wanner, H.* *Ann. Phys. n. F.* 68 (1899) 143-144.  
*Young, C. A.* *Nature* 52 (1895) 458.

## DARK LINES.

- Becquerel, H.* *C.-R.* 122 (1896) 689-694.  
 ——. *C. R.* 124 (1897) 984-988 See *Perrigot*, same vol., 857-859.  
*Campbell, W. W.* *Astrophys. J.* (1895) 177-184; *Beibl.* (1896) 372.  
*Deslandres, H.* *C.-R.* 119 (1894) 148-151; *Beibl.* (1895) 67.  
*Kelvin, Lord.* *Astrophys. J.* 9 (1899) 231.  
*Krone, H.* *Verh. deutsch. Naturf. u. Aerzte II* 1 (1899) 171.  
*Johnson, A.* *Trans. Roy. Soc. Canada* 9 (1893) 825.  
*Le Bon, G.* *C.-R.* 14 (1897) 755-758, 1140-1151. See *Becquerel*, same vol., 984.  
 ——. *C.-R.* 128 (1899) 174-176; *Beibl.* (1899) 387.  
*Perrigot.* *C.-R.* 124 (1897) 857-859. See *Becquerel*, same vol., 984-988.  
*Stefanini, A.* *Nuovo Cim.* (4) 3 (1896) 306-307.  
*Zenger Ch. V.* *C.-R.* 103 (1887) 454-456; *Beibl.* (1887) 94.

## DENSITY.

- Blitz H., und V. Meyer.* *Ber. chem. Ges.* 22 (1889) 725-727.  
*Huggins, Sir W., and Lady Huggins.* *Astrophys. J.* 6 (1897) 322-327.  
*MacGregor, J. G.* *Trans. Roy. Soc. Canada III* (1891) 27-41; *Beibl.* (1893) 123.  
*Peddie, W.* *Rept. Brit. Assoc.* (1892) 661; *Beibl.* (1893) 105-108.  
*Rayleigh, Lord.* *Nature* 46 (1892) 512.  
 ——. *Proc. Roy. Soc.* 54 (1894) 340-344; *Chem. News* 69 (1894) 231-232.

- Traube, J.* Ber. chem. Ges. 29 (1896) 2731-2742.  
*Villard, P.* Soc. franç. de phys. (1896) 73-82.  
*Walter, B.* Ann. Phys. n. F. 34 (1888) 316-326.

## DIAMOND.

- Kunz, G. F.* Beibl. (1891) 650.  
*Sella, A.* Beibl. (1892) 423.  
*Walter, B.* Jahresb. d. Hamburger wiss. Anstalt 8 (1891) 5 pp.

## DIDYMIUM.

- Bailey, G. H.* Rept. Brit. Assoc. (1887) 654; Ber. chem. Ges. 20 (1887) 2769-2770.  
*Becquerel, H.* Ann. chim. phys. (6) 14 (1888) 257-279, planche.  
*Boisbaudran, F.* Lecoq de. C. R. 105 (1887) 258, 301, Beibl. (1887) 786.  
*Crookes, W.* Chem. News 60 (1889) 27.  
*Demarcay, E.* C.-R. 105 (1887) 276; Beibl. (1887) 353; Ber. chem. Ges. (1887) 533.  
*Dummer, G.* Sitzb. Wiener Akad. 106 (1897) 1087-1102; Beibl. (1898) 481.  
*Forsling, S.* Bih. Svensk. Vet. Akad. Handl. (1893) 23 pp.; Beibl. (1894) 562.  
———. Bih. Svensk. Vet. Akad. Handl. (1898) No. 5; Beibl. (1899) 484.  
*Hartinger, L.* Monatsch. f. Chem. 12 (1891) 362-367; Beibl. (1892) 150.  
*Kruss, G.* Liebig's Ann. 265 (1891) 1-27.  
*Langmuir, A. C.* Index to Didymium. Smithsonian Misc. Coll. No. 972 (1894) 20 pp.  
*Linnemann, E.* Monatsh. f. Chem. 6 (1885) 531-536.  
*Living, G. D.* Cambridge Proc. 10 (1899) 40-44; Beibl. (1899) 782.  
*Lohse, O.* Astrophys. J. 6 (1897) 95-118.  
*Schottlaender.* Ber. chem. Ges. 25 (1892) 368-394, 569-599.

## DIFFRACTION.

- Bosc, J. C.* Proc. Roy. Soc. 60 (1896) 167-178.  
*Césaro, E.* Nuov. Cim. (3) 28 (1890) 5-10; Beibl. (1891) 521.  
*Cinelli, M.* Nuov. Cim. (4) 1 (1895) 141-155; Beibl. (1895) 788.



- Cornu, A.* C.-R. 116 (1893) 1215-1222; 1421-1428; J. de phys. (3) 2 (1893) 385-393, 441-449.  
 ——. C.-R. 117 (1893) 1032-1039.  
*Croft, W. B.* Phil. Mag. (5) 37 (1894) 70-81; Chem. News 69 (1894) 71.  
*Filon, L. N. G.* Phil. Mag. 47 (1899) 441-461.  
*Gouy.* Ann. chim. phys. (6) 8 (1886) 145-192.  
 ——. C.-R. 123 (1896) 43-44.  
*Hess, W.* Ann. Phys. n. F. 36 (1889) 264-270.  
*Hurion, A.* J. de phys. (2) (1890) 55-57.  
*Lépinay, J. Macé de.* J. de phys. 5 (1896) 303-306.  
*McConnel, J.* Phil. Mag. (5) 27 (1889) 272-289; 29 (1890) 167-173; Beibl. (1890) 520.  
*Meslin, G.* Ann. chim. phys. (7) 3 (1894) 362-408, 563-574; Beibl. (1895) 175, 499.  
 ——. C.-R. 118 (1894) 853-856; 119 (1894) 214-217; Beibl. (1894) 1001; (1895) 175, 499.  
*Müller, F. C. G.* Ztsch. phys. u. chem. Unterr. 3 (1890) 247.  
*Nagaoka, H.* Beibl. (1893) 1070.  
 ——. J. Coll. Sci. Tokio 9 (1895) 13 pp.; Beibl. (1895) 788  
 ——. Phil. Mag. (5) 45 (1898) 1-23.  
*Poynting, J. H.* Proc. Birmingham Phil. Soc. 7 (1890) 210-219.  
*Pulfrich, C.* J. de phys. (3) 5 (1896) 73-79.  
*Schuster, A.* Phil. Mag. (5) 31 (1891) 77-86.  
*Sommerfeld, A.* Verh. deutsch. Naturf. u. Aerzte II 1 (1896) 34-35.  
*Spee, E.* Bull. Acad. Roy. Belg. (3) 12 (1886) 439; Beibl. (1887) 786.  
*Weiss, P.* C.-R. 128 (1899) 876-877.  
*Wood, R. W.* Phys. Rev. 5 (1897) 1-10.  
 ——. Science 9 (1899) 859-862.

## DIFFUSION.

- Chappuis, J.* C.-R. 114 (1892) 286-288; Beibl. (1892) 425.  
*Chwolson, O.* Repert. d. Phys. 23 (1887) 139-159; Beibl. (1887) 149.  
 ——. Repert. d. Phys. 26 (1890) 385-405; Beibl. (1891) 648.  
*Crova, A.* C.-R. 109 (1889) 493-496.  
 ——. Ann. chim. phys. (7) 20 (1890) 480; 25 (1892) 534; C.-R. 112 (1891) 1176, 1246.  
 ——. Ann. chim. phys. (6) 25 (1892) 534-567.  
*Hagenbach, A.* Ann. Phys. n. F. 60 (1896) 124-133.  
*Imbert, A., et H. Bertin-Sans.* C.-R. 122 (1896) 524-526.  
*Kobbe, F.* Chem. Centralbl. (4) 2 (1890) 617.  
*Liesegang, R. E.* Beibl. (1897) 982.

- Lockyer, J. N. Proc. Roy. Soc. 49 (1896) 342-343; Beibl (1896) 775.  
 Lommel, E. Ann. Phys. n. F. 36 (1889) 473 502.  
 Malagoli, R., e C. Bonacini. Rend. Accad. Lincei 7 (1898) 90-104  
 263 270.  
 Provenzani, P. F. S. Atti Accad. Pontif. Nuov. Lincei 45 (1892) 29-  
 35.  
 Spring, W. Bull. Acad. roy. Belg. 37 (1899) 300-315; Beibl. (1899)  
 633.  
 Sumner, W. E. Chem. News 66 (1892) 300 302; Beibl (1893) 821.  
 Verdet. See A. Crova, Ann. chim. phys. (6) 20 (1890) 480-504.  
 Bibliography of D.  
 Walden, P. Ztsch. physikal. Chem. 10 (1892) 699-732.  
 Wiedeburg, O. Ztsch. physikal. Chem. 10 (1892) 509 516  
 ———. Ztsch. physikal. Chem. 9 (1892) 143-152.  
 Wiener, O. Ann. Phys. n. F. 49 (1893) 105.

## DISPERSION.

- Abati, G. Gazz. chim. Ital. 27 (1897) 437-455. Beibl (1898) 397.  
 Barbier, Ph., et L. Roux. C. R. 108 (1889) 1249, 110 (1890) 457, 527,  
 1071, 111 (1890) 180, 235; 112 (1891) 582; Jahresb. (1889) 315;  
 (1890) 390-392.  
 Battelli, A., e A. Garbasso. Nuov. Cim. (4) 3 (1896) 321-324.  
 Becquerel, H. C.-R. 127 (1898) 899-904; 128 (1899) 146-151.  
 Bělopolski, I. Bull. Acad. St. Petersb. 3 (1895) 379 403; Beibl.  
 (1896) 370.  
 Bloch, R. S. C. R. 111 (1890) 822 824; 116 (1893) 746 748; Beibl.  
 (1891) 213; (1893) 1046.  
 Borel, G. A. Arch. de Genève (3) 34 (1895) 134-158, 230-249; Beibl.  
 (1896) 42.  
 Borgesius, A. H. Vers. Akad. Amsterdam (1895) 99; Ann. Phys. n.  
 F. 54 (1895) 221 243.  
 Breuer, A. I. Theil. Hannover: Bachmeister 1889; 2. Theil. Erfurt:  
 Bachmeister 1891.  
 Bruchl, J. W. Ztsch. physikal. Chem. 7 (1891) 140-193.  
 Carvallo, E. C.-R. 112 (1891) 521-523; Beibl. (1891) 563.  
 ———. C.-R. 120 (1895) 88 91.  
 ———. C.-R. 126 (1898) 728 731, 950 953; Beibl. (1899) 31.  
 Costa, T. Gazz. chim. Ital. (1889) 478; Jahresb. (1890) 390.  
 Cotton, A. Ann. chim. phys. (8) 8 (1896) 347 432.  
 Decombe, L. C.-R. 128 (1899) 172 174; Beibl. (1899) 852.

- Deslandres, H.* C.-R. 104 (1887) 972-976; Beibl. (1888) 47.  
 ——. Ann. chim. phys. (6) 15 (1888) 5-86.
- Dijken, D.* Diss., Groningen 1897, 6 n. pp.; Beibl. (1897) 333.
- Dongier, R.* C.-R. 125 (1897) 228-230.
- Dubois, H. E. J. G., und H. Rubens.* Sitzb. Berliner Akad. (1890) 955-968.
- Dussaud, F.* C.-R. 113 (1891) 291-292.
- Fuchtbauer.* Verh. deutsch. Naturf. u. Aerzte (1893) 19-22.
- Gladstone, J. H.* Chem. News 55 (1887) 300; Jahresb. (1887) 339.  
 ——— and *W. H. Perkin.* Rept. Brit. Assoc. (1889) 515.  
 ——— and *G.* Rept. Brit. Assoc. (1890) 772.  
 ———. J. Chem. Soc. 59-60 (1891) 290-301; Beibl. (1891) 552-555.  
 ———. Phil. Mag. (5) 35 (1893) 204-210.
- Glazebrook R. T.* Rept. Brit. Assoc. (1893) 688-689.
- Goldhammer, D.* J. russ. phys. chem. Ges. 18 (1886) 239-267: 24 (1892) 17-39.
- Guglielmo, G.* Rend. Accad. Lincei (4) 6 (1890) 195-199; Beibl. (1891) 105.
- Hasselberg, B.* Oefvers. Akad. Vorh. 49 (1892) 441-449; Beibl. (1893) 915.
- Heaviside, O.* Electrician 37 (1896) 470-472.
- Helmholtz, H. von.* Ann. Phys. n. F. 48 (1893) 389, 723.
- Henry, P.* C.-R. 112 (1891) 377-380; Beibl. (1891) 355.
- Herschel, A. S.* Rept. Brit. Assoc. (1885) 942-944; Beibl. (1888) 336.
- Horn, C.* Diss., Göttingen (1898) 72 pp.; Beibl. (1899) 183.
- Hupe, A.* Progr., Charlottenberg, Ostern 1894, 46 pp.
- Kayser, H., und Runge, C.* Abhandl. d. preuss. Akad. (1893) 161-191; Beibl. (1893) 293.
- Kelvin, Lord.* Nature 58 (1898) 546; Rept. Brit. Assoc. (1898) 783.
- Ketteler, E.* Ann. Phys. n. F. 49 (1893) 382; 53 (1894) 825-831. See Paschen, ib. 812.
- Kolacek, F.* Ann. Phys. n. F. 32 (1887) 224-256, 428.
- Liveing, G. D., and J. Dewar.* Phil. Mag. (5) 39 (1895) 268-272 Beibl. (1896) 193.
- Lowe, K. F.* Ann. Phys. n. F. 66 (1898) 390-410, 582-596.
- Marx, E.* Ann. Phys. n. F. 66 (1898) 411-434, 598-622.
- Moreau, G.* C.-R. 120 (1895) 258.
- Nasini, R.* Rend. Accad. Roma 6 (1890) 211-215; 299-301; Jahresb. (1890) 356.  
 ——— e *T. Costa.* Univ. Roma, Ist. chim. (1891) 147 pp.; Beibl. (1893) 111.

- Paschen, F.* Ann. Phys. n. F. 53 (1894) 301, 337 342, 812-822; 54 (1895) 668-674.
- Perreau, F.* Ann. chim. phys. (7) 7 (1896) 289-348; Beibl. (1896) 192.
- Perrot, F. L.* C. R. 111 (1890) 967.
- — — Arch. de Genève 25 (1891) 26-70; Beibl. (1891) 357.
- Pflugger, A.* Ann. Phys. n. F. 56 (1895) 412-432; 58 (1896) 670; 65 (1898) 173 213, 225 228.
- Pulfrich, C.* Ztschr. Instrum. 13 (1893) 267-273.
- Rayleigh, Lord.* Phil. Mag (5) 48 (1899) 151-152.
- Reiff, R.* Ann. Phys. n. F. 55 (1895) 82-94.
- Righi* Atti Accad. Lincei 5 (1896) 342-348.
- Rubens, H.* Verh. d. physikal. Ges. Berlin 10 (1891) 83-84.
- — — Ann. Phys. n. F. 51 (1894) 381; 53 (1894) 267-286; 54 (1895) 476-485.
- — — und *A. Trowbridge.* Ann. Phys. n. F. 60 (1897) 724-739.
- Rydberg, J. R.* Oefvers. Svensk. Akad. Forh. 50 (1893) 693-697; Beibl. (1895) 486.
- Shea, D.* Ann. Phys. n. F. 47 (1892) 177.
- Sierstema, L. H.* Zittigsversl. Akad. Amsterdam 7 (1898) 289-297.
- Simon, H. Th.* Ann. Phys. n. F. 53 (1894) 542.
- Steinheil, R.* Diss., Muenchen (1889); Beibl. (1891) 558.
- Stscheglaieff, J.* J. de phys (3) 4 (1895) 546-551; Beibl. (1896) 272.
- — — J. russ. phys. chem. Ges. 28 (1896) 41-55; Beibl. (1897) 409.
- Tikhoff, G. A.* Mem. Spettr. Ital. 27 (1898) 41.
- Voigt, W.* Ann. Phys. n. F. 68 (1899) 598-603.
- Wallach, O.* Götting. Nachr. (1896) 69 73. Beibl. (1897) 732.
- Wilson, E.* Phil. Mag. (5) 26 (1888) 385; Jahresb. (1888) 427.
- Winkelmann, A.* Vers. deutsch. Naturf. u. Aerzte (1887) 83; Ann. Phys. 32 (1887) 439-442.

## DISPLACEMENT OF LINES

- Bélopolsky, A.* Astron. Nachr. 137 (1894) 33 36. Beibl. (1895) 418.
- Bricard, R.* C.-R. 123 (1896) 939.
- Keeler, J. E.* Astrophys. J. 1 (1895) 352 353

## DISSOCIATION

- Gramont, A. de.* C.-R. 122 (1896) 1411-1413; Beibl. (1896) 693.
- — — Ann. chim. phys (7) 10 (1897) 213 234, Chem. News 78 (1898) 270.

*Le Blanc, M.* Ztsch. f. physikal. Chem. 4 (1889) 553-560; Beibl. (1890) 272.

## DISTRIBUTION OF LINES.

*Angström, K.* Oefvers. Svensk. Vet. Akad. Forh. 47 (1890) 331-352.

*Basso, G.* Nuovo Cim. 5 (1886) 210-226.

*Hargreaves, R.* Cambridge Proc. 9 (1896) 69-72.

*Michelson, A. A.* Astrophys. J. 2 (1896) 251-263; Beibl. (1896) 532.

## DOUBLE SPECTRA.

*Baly, E. C. C.* Proc. Roy. Soc. 57 (1895) 468-489.

*Étard, A.* C.-R. 124 (1897) 1351-1355.

*Julius, V.* Ann. École polytechn. de Delft 5 (1889) 118-128; Beibl. (1889) 496-499.

*Mascari, A.* Mem. Spettr. Ital. 27 (1898) 81-90.

*Riccò, A.* Astron. Nachr. 138 (1895) 287-288; Astrophys. J. 2 (1895) 236.

*Stoney, G. J.* Rept. Brit. Assoc. (1891) 574.

— — —. Dublin Trans. (2) 4 (1891) 563-608; Beibl. (1892) 531.

— — —. Rept. Brit. Assoc. (1894) 583-585; Beibl. (1895) 423.

*Zeeman, P.* Zitt. Akad. Amsterdam, Aft. Natuurk. (1897-1898) 13, 99; Phil. Mag. (5) 43 (1897) 226-239, 255-259; 44 (1897) 55-61.

## DUST SPECTRA.

*Living and Dewar.* Proc. Roy. Soc. (1891) 437-440; Beibl. (1891) 279.

## DYE-STUFFS.

*Bothamley, C. H.* J. Chem. Industr. Manchester 6 (1887) 423; Jahresb. (1887) 2723.

— — —. Engineering 60 (1895) 566.

*Buss, O.* Diss., Bern, 1896; Beibl. (1897) 130.

*Eder, J. M.* Monatsh. f. Chem. 7 (1886) 331-350.

*Fischer, O., und Busch, M.* Ber. chem. Ges. 24 (1891) 1870-1874.

*Garbasso, A.* Nuovo Cim. 8 (1898) 264-265.

*Graebe, C.* Ztsch. f. physikal. Chem. 10 (1892) 673-698; Beibl. (1893) 336.

*Haacke, C.* Diss., Tübingen, 1894, 49 pp. u. 2 Taf. (Fuchsin.)

*Hlawatsch, C.* Ztsch. f. Kryst. u. Min. 27 (1896) 605-607.

*Kehrmann, F.* Chem. Ztng. 14 (1890) 93, 146-147, 508, 527, 541.

- Lehmann, O.* Ztsch. f. physikal. Chem. 14 (1894) 155-157.  
*Liesegang, R. Ed.* Beibl. (1894) 341.  
*Nichols, E. L.* Amer. J. Sci. (3) 28 (1884) 342; Jahresb. (1884) 205.  
 — — — and *B. W. Snow.* Phil. Mag. 32 (1891) 401-424;  
 Beibl. (1892) 361.  
*Patterson, T. L.* J. Soc. Chem. Industr. Manchester 9 (1890) 36;  
 Jahresb. (1890) 2547.  
*Pflüger, A.* Ann. Phys. n. F. 56 (1895) 412-432; Astrophys. J. 5  
 (1897) 67.  
 — — —. Ann. Phys. n. F. 65 (1898) 173-213, 225-228; Astrophys.  
 J. 9 (1899) 187.  
*Schoop, P.* Dingler's pol. J. 262 (1886) 424; Jahresb. (1886) 1988.  
*Smith, C. M.* Edinburgh Proc. 17 (1889-1890) 121-127.  
 — — —. Nature 41 (1890) 573.  
*Stscheglaieff, J.* Beibl. (1896) 272; (1897) 409. (Fuchsin.)  
*Tschirch, A.* Naturwiss. Rundsch. 11 (1896) 240-242; Beibl. (1896)  
 535.  
*Vogel, E.* Photogr. Mittheil. 28 (1891) 140-141.  
*Vogel, H. W.* Ann. Phys. n. F. 28 (1886) 130; Jahresb. (1886) 305.  
 — — —. Sitzb. Berliner Akad. (1887) 715-718.  
*Walter, B.* Ann. Phys. n. F. 57 (1896) 394-396. (Fuchsin.)  
*Wood, R. W.* Phil. Mag. (1898) 380-386; Astrophys. J. 9 (1899)  
 188, Abs.

## EBONY.

- Arno, R.* Atti Accad. Torino 28 (1892-1893) 414-416, Beibl. (1894)  
 455.  
*Bianchi, F.* Nuov. Cim. (4) 8 (1898) 285-296; Beibl. (1899) 637.  
*Campanile, F.* Nuov. Cim. (4) 1 (1895) 259-261.

## ELECTRIC SPECTRA

- Abney, W. de W.* Jahrb. f. Photogr. u. Reprod. (1899) 338-350.  
*Ames, J. S.* Astrophys. J. 3 (1896) 294-295.  
 — — —, *R. F. Earhart,* and *H. M. Reese.* Johns Hopkins Univ.  
 Cir. 17 (1898) 53; Beibl. (1898) 892.  
*Angstrom, K.* Oefvers. Vet. Akad. Forh. Svensk 48 (1891) 373-  
 379.  
 — — —. Acta Soc. Upsal. (1893) 1-8; Beibl. (1894) 556.  
*Aubel, Edm. van.* J. de phys. (3) 7 (1898) 408-409.  
*Baldwin, C. W.* Phys. Rev. 3 (1896) 370-380, 448-458.

- Barus, C.* Amer. J. Sci. (4) 3 (1897) 107-117.
- Battelli, A., e A. Carbasso.* Nuov. Cim. (4) 3 (1896) 321-324.
- Beattie, J. Carruthers, and M. Smolchowski de Smolan.* Phil. Mag. (3) 48 (1897) 418-439.
- Beckmann.* Ztsch. f. Electrochem. 5 (1899) 3271; Beibl. (1899) 778.
- Becquerel, Edm.* C.-R. 101 (1885) 205-210.
- Becquerel, H.* C.-R. 125 (1897) 679-685; Beibl. (1898) 353.
- . C.-R. 126 (1898) 187.
- . C.-R. 127 (1898) 953.
- et *H. Deslandres.* C.-R. 127 (1898) 18-24; Beibl. (1898) 891.
- , ———. C.-R. 126 (1898) 997-1001; Beibl. (1899) 54.
- Benoist, L., et D. Hurmuzescu.* J. de phys. (3) 5 (1896) 110-111.
- Bettendorff, A.* Liebig's Ann. 270 (1892) 376-383; Beibl. (1892) 744.
- Bidwell, S.* Nature 41 (1890) 151-154.
- Birkeland, M.* C.-R. 123 (1896) 492-495.
- . C.-R. 126 (1898) 228-231.
- Blondel, A.* Éclair. électr. 10 (1897) 289-299.
- Blondlot, R.* C.-R. 106 (1888) 349-354.
- Blythwood, Lord.* Proc. Roy. Soc. 49 (1896) 330-332.
- Boisbaudran, F. Lecoq de.* C.-R. 102 (1886) 153, 468, 629; Jahresb. (1886) 308, 311.
- ———. C.-R. 111 (1890) 472-474; Jahresb. (1890) 400.
- Borgmann, J. J.* C.-R. 124 (1897) 895-896.
- Bose, J. C.* Proc. Roy. Soc. 59 (1896) 160-167, 167-178; Phil. Mag. (5) 43 (1897) 55-69, 260; Electrician 37 (1896) 788-791.
- Bottomley, J. T.* Nature 53 (1896) 268-269.
- Bouty, E.* Soc. franç. de phys. 3 (1895) 218-222.
- Brandes, G.* Sitzb. Berliner Akad. (1896) 547-550.
- Branly, E., et G. Le Bon.* C.-R. 128 (1899) 879-882.
- Broca, A.* Soc. franç. de phys. (1898) 23-31.
- Brooks, E. E.* Chem. News 62 (1890) 239; Beibl. (1891) 109.
- ———. Chem. News 64 (1891) 30; Beibl. (1892) 426.
- Buguet, A.* C.-R. 125 (1897) 375-377.
- Buisson, H.* C.-R. 127 (1898) 224-227; Beibl. (1898) 803.
- Burbank, J. E.* Amer. J. Sci. (4) 5 (1898) 53-55.
- Cajori, F.* Amer. J. Sci. (4) 2 (1896) 289-290.
- Campanile, F., e Stromei, E.* Nuov. Cim. (4) 6 (1897) 417-421; Beibl. (1898) 702.
- Cardani, P.* Atti Accad. Roma 4 (1895) 242-250.
- Carrara, G., e A. Minozzi.* Gazz. chim. Ital. 27 (1897) 455-467; Beibl. (1898) 560.



- Chabaud, V.* C.-R. 122 (1896) 237-238.
- Chill, C. D., and O. M. Stewart.* Phys. Rev. 4 (1897) 502-504.
- Clayden, A. W.* Rept. Brit. Assoc. (1889) 507; Phil. Mag. (5) 27 (1889) 92-94.
- Colardeau, J.* de phys. 6 (1887) 83-90.
- Cole, A. D.* Phys. Rev. 4 (1896) 50-61.
- Collie, J. N., and W. Ramsay.* Proc. Roy. Soc. 59 (1896) 257-270.
- Corbino, O. M.* Rend. Accad. Roma (5) 7 (1898) 241-246; Beibl. (1898) 694, 891.
- — —. Nuov. Cim. 9 (1899) 391-394; Beibl. (1899) 675.
- Cornu, A.* C.-R. 122 (1896) 1455-1462.
- — —. Soc. franç. de phys. (1897) 138-143; Astrophys. J. 6 (1897) 378-383.
- — —. C.-R. 126 (1898) 181-187, 300; Astrophys. J. 7 (1898) 163-169.
- Cotton, A.* C. R. 125 (1897) 865-867; Beibl. (1898) 352.
- — —. Éclair. electr. 14 (1898) 299; Beibl. (1898) 354.
- — —. Éclair. electr. 14 (1898) 540-547; Beibl. (1898) 890.
- — —. C.-R. 127 (1898) 953-955; Beibl. (1899) 509.
- — —. C.-R. 128 (1898) 294-297; Beibl. (1899) 509.
- Decombe, L.* Arch. de Genève (4) 4 (1897) 30-38.
- Demarçay, E.* C.-R. 104 (1887) 678; Beibl. (1887) 703.
- — —. Spectres électriques. Paris: Gauthier-Villars, 1895. 4to, 91 pp.
- Dennis, L. M.* J. Amer. Chem. Soc. 20 (1898) 1.
- Deslandres, H.* J. de phys. (2) 10 (1891) 276-281.
- — —. Knowledge 18 (1895) 59-60.
- — —. C. R. 120 (1895) 1259-1260.
- — —. C.-R. 125 (1897) 373-375.
- Drude, P.* Arch. de Genève (3) 3 (1897) 464-476.
- Dudley, W. L.* Chem. News 66 (1892) 163-165; Beibl. (1893) 123, 206.
- Dufour, H.* Arch. de Genève (4) 1 (1896) 82, 91, 111-117.
- Ebert, H.* Arch. de Genève 25 (1891) 489-503.
- — —. Astron. and Astrophys. 12 (1893) 804-810; Beibl. (1894) 339.
- Eder, J. M.* Denschr. d. Wiener Akad. 60 (1893) 24 pp.; Beibl. (1894) 910-912.
- — — u. *E. Valenta.* Wiener Anzeiger (1893) 21-24.
- — —. Denschr. d. Wiener Akad. (1898) 11 pp.; Beibl. (1899) 250.
- Ekstrom, A.* Ann. Phys. n. F. 64 (1898) 315-324.

- Exner, F.*, u. *E. Haschick*. Sitzb. Wiener Akad. 104 IIa (1895) 909-962; 105 IIa (1896) 389-436; 503-574. 707-740. 989-1013; 106 IIa (1897) 36-52. 54-68. 337-356. 494-520; Beibl. (1896) 129, 693; (1897) 227. 413. 735.
- . Sitzb. Wiener Akad. 106 (1897) 1127-1152; 107 (1898) 182-206. 813-837. 1335-1380; Beibl. (1898) 400. 559; (1899) 420.
- Fauth, Ph.* Sirius 24 (1896) 169.
- Fessenden, R. A.* Astrophys. J. 3 (1896) 36-40.
- Fizee, Ch.* Bull. Acad. roy. Belg. (3) 9 (1885) 381; Jahresb. (1885) 319.
- Fitzgerald, G. F.* Nature 59 (1898) 222. 509. 557.
- Fleming, J. A.* Phil. Mag. (5) 41 (1896) 52-102.
- Foley, A. L.* Phys. Rev. 5 (1897) 129-152.
- Fomm, L.* Naturwiss. Rundsch. 11 (1896) 304.
- Fowler, A.* Nature 46 (1892) 268; Beibl. (1893) 125.
- Fuchs, P.* Beibl. (1898) 218.
- Garbasso, A.* Nuov. Cim. (4) 2 (1895) 120-122.
- . Rend. Accad. Roma 5 (1896) 250-254.
- . Nuov. Cim. (4) 6 (1897) 8-14; Beibl. (1898) 433.
- Gladstone, J. H.*, and *Hibbert, W.* Rept. Brit. Assoc. (1891) 609; Beibl. (1892) 605.
- . Chem. News 78 (1898) 109-300.
- and *W. H. Perkin*. Rept. Brit. Assoc. (1889) 515.
- Gloeser, M.* Ztsch. phys. u. chem. Unterr. 6 (1892) 303-304.
- Goldhammer, D. A.* Ann. Phys. n. F. 67 (1899) 696-701.
- Gouy, C.-R.* 122 (1896) 1197-1198.
- Gramont, A. de.* C.-R. 118 (1894) 591-594. 746-749; Beibl. (1894) 838.
- . C.-R. 126 (1898) 1155-1157. 1234. 1513-1515; Beibl. (1898) 774.
- Greene, F.* Rept. Brit. Assoc. (1889) 617.
- Guillaume, Ch.* C.-R. 123 (1896) 450-452.
- Hale, G. E.* Astrophys. J. 3 (1895) 318-334.
- Hallwachs, W.* Göttinger Nachr. (1889) 99 pp.; Ann. Phys. n. F. 37 (1889) 666-675.
- Hartley, W. N.* Proc. Roy. Soc. Dublin 6 (1890) 363-374.
- . Proc. Roy. Soc. 40 (1891) 448-451; Beibl. (1891) 714.
- . Proc. Roy. Soc. 54 (1894) 344-349; Beibl. (1894) 1046.
- . Proc. Roy. Soc. 57 (1895) 293-296; Beibl. (1895) 635.
- . Proc. Roy. Soc. 60 (1896) 216-221.

- Haschek, E.* Wiener Anzeiger (1896) 75.  
 — — und *H. Mach*. Sitzb. Wiener Akad. 107 II (1898) 1253-1265.  
*Hasselberg, B.* K. Svensk. Vet. Handl. 26 (1894) No. 5.  
 — —. Astrophys. J. (1896) 116 134, 212 233.  
 — —. K. Svensk. Akad. Handl. 28 (1896) No. 6; 30 (1897) 20 pp.; 32 (1899) 38 pp.; Beibl. (1898) 401; (1899) 634.  
*Heen, P. de.* Bull. Acad. roy. Belg. (3) 32 (1896) 277 279.  
 — —. C. R. 124 (1897) 459. Bull. Acad. roy. Belg. 33 (1897) 205-210, 800-802.  
 — —. Bull. Acad. roy. Belg. (3) 33 (1897) 321-323.  
*Helmholtz, H. von.* Ann. Phys. n. F. 48 (1893) 389, 723.  
*Hemptinne, A. de.* C. R. 125 (1897) 428 431.  
 — —. Bull. Acad. roy. Belg. (3) 37 (1899) 447-449.  
*Hemsalech, G. A.* Phil. Mag. (5) 43 (1897) 289-291.  
 — —. C.-R. 129 (1899) 285-288.  
*Henry, C., et G. Seguy.* C. R. 122 (1896) 1198-1200.  
*Hertz, H.* Sitzb. Berliner Akad. (1887) 487-490.  
*Hodgkinson, W. R.* Chem. News 58 (1888) 187, 223-224.  
*Hoffmann, M. W.* Ann. Phys. n. F. 60 (1897) 642-652.  
*Hoor, M.* Repert. d. Phys. 25 (1889) 91-119; Wiener Anzeiger (1888) 118.  
*Hull, G. F.* Phys. Rev. 5 (1897) 231-246.  
*Humphreys, W. J.* Astrophys. J. 4 (1896) 249-262.  
 — —. Phil. Mag. (5) 44 (1897) 401-404.  
 — —. W., and *J. P. Mohler.* Astrophys. J. 3 (1895) 114-118. Beibl. (1896) 583.  
*Hurmuzescu, D.* Éclairage électr. 15 (1898) 166 168.  
*Imbert, A., et Bertin-Sans, H.* C.-R. 122 (1896) 524-526.  
*Jackson, H.* Chem. News 72 (1895) 150.  
*Jaumann, G.* Mitth. d. deutsch. math. Ges. zu. Prag (1892) 146-151.  
 — —. Sitzb. Wiener Akad. 106 Ila (1897) 533-550.  
 — —. Ann. Phys. n. F. 64 (1898) 262 278.  
 — —. Ann. Phys. n. F. 67 (1899) 741 780.  
*Jewell, L. E.* Astrophys. J. 3 (1896) 89-113.  
 — —. Astrophys. J. 8 (1898) 51-53; Johns Hopkins Univ. Cir. 17 (1898) 62-63.  
*Kalachne, A.* Ann. Phys. n. F. 65 (1898) 815-848.  
*Kalischer, S.* Naturwiss. Rundsch. 10 (1895) 86-88.  
*Kaufmann, W.* Verh. d. physikal. Ges. 16 (1897) 116-118.

*Kayser, H.* *Astrophys. J.* 1 (1895) 84.

———. *Abhandl. d. Berliner Akad.* (1897) 44 pp.; *Astrophys. J.* (1898) 93, 173.

——— u. *C. Runge.* *Ann. Phys. n. F.* 38 (1889) 80–90.

*Kehrmann, F., und N. Pickersgill.* *Ber. chem. Ges.* 24 (1891) 2324–2326.

*Kelvin, Lord.* *Proc. Roy. Soc.* 49 (1896) 332–333.

———. *Rept. Brit. Assoc.* (1898) 783–787; *Phil. Mag.* (5) 46 (1898) 494–500.

——— and *R. S. de Smolan.* *Nature* 55 (1887) 343–347.

———, *J. Beattie, J. Carruthers, and R. S. de Smolan.* *Edinb. Proc.* 21 (1897) 393–428.

*Koenig, W.* *Ztsch. d. Electrochem.* 3 (1896) 54–61.

———. *Ann. Phys. n. F.* 62 (1897) 240–248; 63 (1897) 268–272.

*Lampa, A.* *Sitzb. Wiener Akad.* 105 IIa (1896) 589–600.

*Lang, V. von.* *Sitzb. Wiener Akad.* 104 IIa (1895) 980–993; 105 IIa (1896) 252–262.

*Larmor, J.* *Phil. Mag.* (5) 44 (1897) 503–513.

*Lea, M. C.* *Amer. J. Sci.* (4) 1 (1896) 363–364.

*Leguy, G.* *C.-R.* 121 (1895) 198–199.

*Lenard, P.* *Ann. Phys. n. F.* 56 (1895) 255–275; *Verh. deutsch. Nat. u. Aerz.* (1897) 69.

*Lienard, A.* *Éclair. électr.* 16 (1898) 330–334; *Beibl.* (1899) 54.

*Liveing, G. D.* *Cambridge Proc.* 10 (1899) 40–44; *Beibl.* (1898) 782.

——— and *Dewar, J.* *Phil. Mag.* (5) 38 (1894) 235–240; *Beibl.* (1895) 60.

*Lockyer, J. N.* *Proc. Roy. Soc.* 54 (1893) 359–361.

——— ——. *Chem. News* 69 (1894) 89; *Beibl.* (1894) 767; *Phil. Trans.* 185 (1895) 983–1029.

*Lodge, O.* *Proc. Roy. Soc.* 60 (1897) 513–516.

*Lorentz, H. A.* *Astrophys. J.* 9 (1899) 37–46; *Beibl.* (1899) 49–53.

*Luedeking, C.* *Chem. News* 61 (1890) 1–2; *Beibl.* (1890) 511.

*Macaluso, B., e O. M. Corbino.* *Nuov. Cim.* 8 (1898) 257–259; *C.-R.* 127 (1898) 548, 951.

———, ——. *Nuov. Cim.* 9 (1899) 381–384; *Rend. Accad. Roma* 8 (1899) 38–41.

———, ——. *Rend. Accad. Lincei* 8 (1899) 116–120.

*Magnanini, G.* *Rend. Accad. Lin. Roma* (5) 2 (1893) 369–376; *Beibl.* (1893) 827.

*Maier, M.* *Ann. Phys. n. F.* 68 (1899) 903–916.

*Malagoli, L., e C. Bonacini.* *Nuov. Cim.* (4) 3 (1896) 307–309.

- Malagoli, L., e C. Bonacini.* Rend. Accad. Roma 7 (1898) 96-104, 263-270.
- , —. Nuov. Cim. 9 (1899) 279-295.
- Maltezos, C.* C. R. 122 (1896) 1474-1476, 1533-1534.
- Marchand, M. E.* Beibl. (1889) 683.
- Mari, E.* Ann. Phys. n. F. 66 (1898) 411-434, 598-622.
- Mazzotto, D.* Nuov. Cim. 5 (1897) 55-57.
- Merritt, E.* Phys. Rev. 5 (1897) 306-309; Beibl. (1898) 245.
- Meslans, M.* C.-R. 122 (1896) 309-311.
- Michelson, A. A.* Astrophys. J. 6 (1897) 48-54; 7 (1898) 131-139; Beibl. (1898) 350.
- Minchin, G. M.* Proc. Roy. Soc. 58 (1895) 133-151; 59 (1896) 231-233.
- Mixter, G. W.* Astrophys. J. 5 (1897) 354-360.
- Mohler, J. F.* Phys. Rev. 4 (1896) 153-154.
- — —. Astrophys. J. 10 (1899) 202-206.
- — — and *L. E. Jewell.* Astrophys. J. (1896) 351-355.
- Moissan, H.* C.-R. 109 (1889) 937-940.
- —. Bull. Soc. chim. Paris 11-12 (1894) 822-828.
- Neesen, F.* Verh. d. Ges. deutsch. Naturf. u. Aerzte (1897) 70-72.
- Niewenglowski, G. H.* Photographie de l'Invisible. Paris: Desforges, 1896, 23 pp.
- Nodon, A.* C.-R. 122 (1896) 237.
- Novak, V., und Suk, O.* Ztsch. f. physikal. Chem. 19 (1896) 489-512.
- Oberbeck, A.* Naturwiss. Rundsch. 11 (1896) 265.
- Onnes, K.* Zittingsversl. k. Akad. Amsterdam. (1896-1897) Januari.
- Paschen, F.* Ann. Phys. n. F. 54 (1895) 668-674.
- Perrin, J.* Soc. franç. de phys. (1896) 40-42, 288; C.-R. 122 (1896) 186-188.
- Pettinelli.* Atti Accad. Lincei 5 (1896) 118-120.
- Pillschikoff.* C.-R. 122 (1896) 461-462.
- Poincaré, H.* Éclair. électr. 9 (1896) 241-251.
- —. Éclair. électr. 11 (1897) 481-489, 18 (1899) 5-15.
- —. C. R. 128 (1899) 339-341.
- Preston, T.* Phil. Mag. (5) 43 (1897) 281-285; Beibl. (1897) 628.
- —. Nature 59 (1898) 248, 367-368; 60 (1899) 175-180.
- —. Proc. Roy. Soc. 63 (1898) 26-31.
- —. Phil. Mag. (5) 47 (1899) 165-179; Beibl. (1899) 508.
- Radiguot.* C.-R. 124 (1897) 179-180.
- Raveau, C.* Soc. franç. de phys. (1896) 42-43. J. de phys. (3) 5 (1896) 113-114.

- Rayleigh, Lord.* Phil. Mag. (5) 45 (1898) 522-525.  
 ———. Nature 59 (1898) 533.  
*Reese, H. H.* Johns Hopkins Univ. Cir. 18 (1899) 59; Phil. Mag. (5) 48 (1899) 317-319.  
*Reiff, R.* Ann. Phys. n. F. 50 (1893) 361.  
*Ricciò, A.* Mem. Spettr. Ital. 24 (1894) 3 pp.  
*Righi, A.* Nuov. Cim. (3) 25 (1889) 193-211.  
 ———. Rend. Accad. Roma 5 (1889) 860-862.  
 ———. Rend. Accad. Roma 7 (1891) 330-333.  
 ———. Nuov. Cim. 35 (1894) 12; (4) 1 (1895) 25-40, 261-263, 245-248, 466-470.  
 ———. Atti Accad. Lincei 5 (1896) 342-348; Phil. Mag. (5) 41 (1896) 230-233.  
 ———. C.-R. 127 (1898) 216-219; Sitzb. preuss. Akad. (1898) 600-603.  
 ———. Rend. Accad. Roma 7 (1898) 41-46, 295-302; Nuov. Cim. (1898) 50, 102; (1899) 295-312; Beibl. (1898) 695.  
 ———. C.-R. 128 (1899) 45-48; Beibl. (1899) 510.  
 ———. Nuov. Cim. 9 (1899) 295-312; 10 (1899) 20-42, 112-115.  
*Rive, L. de la.* Arch. de Genève 23 (1890) 391-401.  
*Roiti.* Rend. Accad. Roma 6 (1897) 29-32; 7 (1898) 87-91.  
*Röntgen, W. C.* Wurzburg phys. med. Ges. (1895) 10 pp.; Nature 53 (1896) 274-276.  
*Rood, O. N.* Amer. J. Sci. (4) 2 (1896) 173-180.  
*Rowland, H. A., N. R. Carmichael, and L. J. Briggs.* Phil. Mag. 41 (1896) 381-382.  
 ——— ——— and *C. N. Harrison.* Astrophys. J. 7 (1898) 273-294.  
 ——— ——— and *R. R. Tatnall.* Astrophys. J. 1 (1895) 14-17, 149-153; 2 (1895) 184-187; 3 (1896) 286-291; Beibl. (1896) 375.  
*Rubens, H.* Verh. d. physikal. Ges. Berlin 9 (1890) 27-31.  
 ——— ——— and *E. F. Nichols.* Phys. Rev. 5 (1897) 98-112, 152-169.  
*Runge, C.* Astrophys. J. 1 (1895) 433; Beibl. (1896) 773.  
*Rutherford, E.* Proc. Roy. Soc. 60 (1896) 184-186.  
 ——— ———. Cambridge Proc. 9 (1898) 401-417; Beibl. (1898) 895.  
*Sagnac, G.* C.-R. 125 (1897) 168-171; 128 (1899) 300-303.  
*St. Dunstan, A., M. E. Rice, and C. A. Krauss.* Amer. J. Sci. (4) 3 (1897) 472-475.  
*St. John, C. E.* Phil. Mag. (5) 38 (1894) 425-441; Amer. J. Sci. (3) 48 (1894) 311-325.  
*Salvioni, E.* Nuov. Cim. 5 (1897) 63-70.

- Sandrucci, A.* Nuov. Cim. 6 (1897) 322-325; Rend. Accad. Roma 7 I (1898) 104-108.
- Schioltz, O. E.* Christiania Vid. Forh. (1898) No. 4; Beibl. (1899) 288.
- Schmidt, G. C.* Ann. Phys. n. F. 64 (1898) 708-724.
- Schumann, V.* Chem. News 63 (1891) 275.
- Schuster, A.* Rept. Brit. Assoc. (1897) 557-559.
- and *G. Hemsalech* Chem. News 79 (1899) 62-64; Proc. Roy. Soc. (1899) 331-336.
- Seguy, G.* C. R. 121 (1895) 198-199.
- et *E. Gundelag.* C. R. 125 (1897) 602-603.
- Sella, A.* Atti Accad. Roma 4 (1895) 237-242, 283-289.
- e *Majorana, Q.* Atti Accad. Roma 5 (1896) 323-327; 389-392.
- Shedd, J. C.* Phys. Rev. 9 (1899) 1-20, 86-116.
- Siersema, L. H.* Zitt. Akad. Amsterdam 7 (1898-1899) 289-297.
- Siethoff, E. G. A.* Zitt. Akad. Amsterdam 5 (1896-1897) Januari.
- Simon, E.* Sitzb. Wiener Akad. 104 II (1895) 565-593.
- Smithells, A., H. M. Dawson, and H. A. Wilson.* Proc. Roy. Soc. 64 (1898) 142-148.
- Smyth, C. P.* Chem. News 60 (1889) 223-224; Beibl. (1890) 119.
- Stefanini, A.* Nuov. Cim. (4) 4 (1896) 18-24; 3 (1896) 306-307.
- Stokes, G. G.* Cambridge Proc. 9 (1896) 215-216.
- Thompson, S. P.* Proc. Roy. Soc. 61 (1897) 481-483.
- — — Chem. News 75 (1897) 103-106, 111-113, 122, 134.
- Thomsen, J.* Ztsch. anorgan. Chem. 10 (1895) 155; Beibl. (1895) 887.
- Thomson, J. J.* Proc. Roy. Soc. 58 (1895) 1; Nature 51 (1895) 330-333.
- Trowbridge, J., and J. Burbank* Phil. Mag. (5) 45 (1898) 100-102.
- Vicentini, G.* Rend. Accad. Roma (5) 1 (1892) 13-17, 143-149, 235-241.
- Villard, P.* Éclair. électr. 16 (1898) 313.
- Villari, E.* Nuov. Cim. (4) 3 (1896) 359-364; 5 (1897) 459-466; 7 (1898) 270-272.
- Violle, J.* C.-R. 117 (1893) 33-34; 119 (1894) 949-951.
- Voigt, W.* Götting. Nachr. (1898) 6 pp.
- — — Verh. deutsch. Naturf. u. Aerzte (1899) 43-47.
- — — Ann. Phys. n. F. 69 (1899) 290-296, 297-318.
- Wagner, J.* Ztsch. f. physikal. Chem. 12 (1893) 314-321; Beibl. (1894) 88.
- Waller, B.* Naturwiss. Rundsch. 11 (1896) 322-323.
- Watt, A.* Dingler's pol. J. 267 (1888) 20-24.
- Wiedeburg, O.* Ann. Phys. n. F. 59 (1896) 497-522.



- Wiedemann, E.*, und *H. Ebert*. *Ann. Phys. n. F.* 35 (1888) 209-264; 36 (1889) 643-655.
- . *Ann. Phys. n. F.* 37 (1889) 177-249; *Phil. Mag.* (5) 28 (1889) 149, 248, 376.
- . *Ann. Phys. n. F.* 38 (1889) 488.
- und *G. C. Schmidt*. *Ann. Phys. n. F.* 60 (1896) 510-518.
- Wilsing, J.*, und *J. Scheiner*. *Ann. Phys. n. F.* 59 (1896) 782-792.
- . *Astron. Nachr.* 142 (1897) 17-22.
- . *Astrophys. J.* 7 (1898) 317-329. See *Do.* III, 114; IV, 175, 249; VI, 169; VIII, 114.
- Wilson, C. T.* *Proc. Roy. Soc.* 64 (1898) 127-130; *Beibl.* (1899) 287.
- Wilson, W. E.*, and *G. F. Fitzgerald*. *Astrophys. J.* 5 (1897) 101-108.
- and *P. L. Gray*. *Proc. Roy. Soc.* 58 (1895) 24-28; *Beibl.* (1895) 890.
- Winckler, Cl.* *Ber. chem. Ges.* 19 (1886) 210.
- Wind, C. H.* *Beibl.* (1899) 327.
- Wood, R. W.* *Sci.* 9 (1899) 337-338.
- Young, C. A.* *Sirius* 22 (1895) 241-244.
- Zeeman, P.* *Vers. Akad. Amsterdam* 4 (1896) 148-152; *Arch. néerland.* 1 (1897) 217-221.
- . *Arch. néerland.* 1 (1897) 221-229; *Phil. Mag.* (5) 45 (1898) 197-201.
- . *Zitt. Akad. Amsterdam* 6 (1897-1898) 13-18, 99-102; *Phil. Mag.* (5) 43 (1897) 226-239, 255-259; 44 (1897) 55-61; *C.-R.* 124 (1897) 1444-1445.
- . *Zitt. Akad. Amsterdam* 7 (1898-1899) 122-124; *Beibl.* (1898) 890.
- Zeleny, J.* *Phil. Mag.* (5) 45 (1898) 272-273.

## EMISSION SPECTRA.

- Ahr, J.* *Beibl.* (1895) 421.
- Ashkinass, E.* *Verh. d. physikal. Ges. Berlin* 17 (1898) 101-105.
- Becquerel, H.* *C.-R.* 122 (1896) 420, 501-504, 559-564, 689-694, 1086-1088.
- Boumann, Z. P.* *Zitt. Akad. Amsterdam* 5 (1896) 438-442.
- Braun, F.* *Götting. Nachr.* (1887) 465-467.
- Eder, J. M.* *Wiener Anzeiger* (1890) 103-105.
- . *Wiener Anzeiger* (1891) 44-47.
- und *E. Valenta*. *Wiener Anzeiger* (1892) 252-253.
- , ———. *Denkschr. d. Wiener Akad.* 60 (1893) 241-262.
- , ———. *Verh. deutsch. Naturf. u. Aerzte* (1895) 78.

- Emden, R.* Ann. Phys. n. F. 36 (1889) 214-236.  
*Erdmann, H.* Naturwiss. Rundsch. 13 (1898) 465-467.  
*Forsling, S.* Bih. k. Svensk. Akad. Handl. 23 (1898) No. 5, Beibl. (1899) 484.  
*Goldstein, E.* Verh. d. physikal. Ges. Berlin (1886) 38-41, Beibl. (1899) 616.  
*Grosse, W.* Beibl. (1889) 679.  
*Guillaume, Ch. Ed.* C.-R. 123 (1896) 450-452.  
*Hartinger, L.* Monatsch. f. Chem. 12 (1891) 362-367.  
*Henry, Ch.* C.-R. 123 (1896) 400.  
*Humphreys, W. J.* Astrophys. J. 6 (1897) 169-232.  
*Hurmuzescu, D.* Éclair. électr. 15 (1898) 166-168.  
*Jaumann, G.* Wiener Anzeiger (1894) 115; Astrophys. J. 2 (1895) 215-223, 241-242.  
*Jones, A. C.* Ann. Phys. n. F. 62 (1897) 30-53.  
*Kaufmann, W.* Verh. d. physikal. Ges. Berlin 16 (1897) 116-118.  
*Kirchhoff, G.* Leipzig: 1898, Beibl. (1899) 140, Abs. by E. Wiedemann.  
*Knies, M.* Naturf. Versamml. (1889) 217-218, Beibl. (1891) 643.  
*Koebesligetty, R. von.* Ann. Phys. n. F. 32 (1887) 677.  
*Kruess, H.* J. f. Gasbeleucht. (1896) 4 pp., Beibl. (1896) 772.  
*Kurlbaum, F.* Ann. Phys. n. F. 67 (1899) 846-858.  
*Langley, S. P.* Phil. Mag. (5) 27 (1889) 1-23.  
*Mewes, R.* Ann. Phys. n. F. 46 (1892) 171.  
*Morize, H.* C.-R. 127 (1898) 545-548.  
*Neovius, O.* Bih. k. Svensk. Akad. Handl. (1891) 69 pp.; Beibl. (1893) 563.  
*Paschen, F.* Ann. Phys. n. F. 50 (1893) 499; 51 (1894) 1, 40; 52 (1894) 209.  
 ——— u. H. Wanner. Sitzb. preuss. Akad. (1899); Astrophys. J. 9 (1899) 300-307.  
*Piltchikoff.* C.-R. 122 (1896) 461-462.  
*Planck, M.* Ann. Phys. n. F. 57 (1896) 1.  
*Pringsheim, E.* Ann. Phys. n. F. 51 (1894) 441.  
*Rizzo, G. B.* Atti Accad. Torino 29 (1893-1894) 292-301; Beibl. (1894) 835.  
*Rosenthal, H.* Ann. Phys. n. F. 68 (1899) 783-800.  
*Rubens, H., und E. Ashkinass.* Ann. Phys. n. F. 64 (1898) 1; Astrophys. J. 8 (1898) 176-192.  
 ———. Ann. Phys. n. F. 64 (1898) 584-601.  
*Rydberg, J. R.* Svensk. Vet. Akad. Handl. 23 (1890) 155 pp.; Beibl. (1891) 351.

- Sagnac, G.* Compt. Rend. 128 (1899) 300-303.  
*St. John, C. E.* Ann. Phys. n. F. 56 (1895) 433-450.  
*Sandrucci, A.* Nuov. Cim. 6 (1897) 322-325.  
 ——. Rend. Accad. Roma 7 I (1898) 104-108.  
*Snow, B. W.* Ann. Phys. n. F. 47 (1892) 208.  
*Stenger, F.* Ann. Phys. n. F. 32 (1887) 271-275. See Weber, same vol., 256-271.  
*Voigt, W.* Ann. Phys. n. F. 67 (1899) 366-387.  
*Weber, H. F.* Ann. Phys. n. F. 32 (1887) 256-271, 491-504.  
 ——. Sitzb. Berliner Akad. (1888) 565-589; Beibl. (1890) 897-900.  
*Wiedemann, E., und Schmidt, G. C.* Ann. Phys. n. F. 56 (1895) 18-26.  
*Wien, W.* Ann. Phys. n. F. 58 (1896) 662-669; Phil. Mag. (5) 43 (1897) 214-220.

## ENERGY IN THE SPECTRUM.

- Angström, K.* Phys. Rev. 3 (1895) 138-141.  
*Berthelot.* C.-R. 127 (1898) 143-160.  
*Ebert, H.* Ann. Phys. n. F. 36 (1889) 592. See Langley, Amer. J. Sci. 36 (1888) 359.  
*Fitzgerald, F. G.* Nature 49 (1893) 149; Beibl. (1894) 669.  
*Guillaume, C.* Beibl. (1894) 337; J. de phys. (3) 4 (1895) 24-39.  
*Handl, A.* Sitzb. Wiener Akad. 94 (1886) 935-946; Beibl. (1887) 585.  
*Helmholtz, R. von.* Verh. d. physikal. Ges. (1889) 51-54; Beibl. (1889) 808.  
*Hoppe, R.* Gruenert's Archiv (2) 7 (1889) 330-336.  
*Hutchins, C. C.* Amer. J. Sci. (3) 39 (1890) 392-395; Beibl. (1890) 778.  
*Kohl, F. G.* Naturwiss. Rundsch. 12 (1897) 425; Beibl. (1897) 983.  
*Langley, S. P.* Mem. Nat. Acad. Sci. 5 (1889) 7-18; Beibl. (1889) 162.  
*Liveing, G. D.* Cambridge Proc. 10 (1899) 38-40; Beibl. (1899) 781.  
*Lummer, O., und E. Pringsheim.* Verh. deutsch. physikal. Ges. 1 (1899) 23-41.  
*Mendenhall, C. E., and F. A. Saunders.* Phil. Mag. (5) 44 (1897) 136.  
 ——. Johns Hopkins Univ. Cir. (1898) 55; Beibl. (1898) 770.  
*Michelson, W. A.* J. russ. phys. chem. Ges. (4) 1 (1887) 979-99; Beibl. (1888) 658-661.

- Newcomb, S.* Nature 49 (1893) 100; Beibl. (1894) 669.  
*Nichols, E. L.* Phys. Rev. 2 (1895) 260-276; Beibl. (1895) 783.  
 ——. Phys. Rev. 4 (1897) 297-313.  
*Paschen, F.* Sitzb. Berliner Akad. (1898) 405-420; Astrophys. J. 10 (1899) 40-57.  
*Pickering, E. C.* Astron. Nachr. 128 (1891) 377-380; Beibl. (1894) 97.  
*Pickering, S. U.* Nature 43 (1891) 165-167.  
*Schumann, V.* Photogr. Rundsch. (1892) 33 pp.  
*Searle, A.* Proc. Amer. Acad. (1888) 26-29; Beibl. (1889) 219.  
*Tunlirz, O., und Krug, A.* Sitzb. Wiener Akad. 97 (1889) 1521-1559; Beibl. (1889) 499.  
*Very, F. W.* Astrophys. J. 10 (1899) 208.  
*Wien, W.* Ann. Phys. n. F. 48 (1893) 20.  
 ——. Ann. Phys. n. F. 58 (1896) 662-669; Phil. Mag. (5) 43 (1897) 214-220.

## ERBIUM.

- Crookes, W.* Chem. News 60 (1889) 27-30, 39-41, 51-53; Beibl. (1890) 173.  
*Forsling, S.* Svensk. Akad. Handl. 24 II (1898) 1-35.  
*Hartley, W. N.* Chem. News 53 (1886) 179; Jahresb. (1886) 311.  
*Humphreys, W. J.* Astrophys. J. 6 (1897) 169-232.  
*Humpidge, T. S.* Chem. News 53 (1886) 154; Jahresb. (1886) 311.  
 See Hartley, p. 179.  
*Kruess, G.* Liebig's Ann. 265 (1891) 1-27.  
*Swinton, A. A. C.* Proc. Roy. Soc. 65 (1899) 115-119.

## ETHERION.

- Brush, C. F.* J. Amer. Chem. Soc. 20 (1898) 899-912. See Dorn, Beibl. (1899) 203.  
*Crookes, W.* Chem. News 78 (1898) 221-223; Beibl. (1899) 203.  
*Dorn, E.* Verh. d. physikal. Ges. Berlin 17 (1898) 135-137; Beibl. (1899) 203.  
*Smolan, R. S. de.* Nature 59 (1898) 223.

## FLAME SPECTRA.

- Abney, W. de W.* Chem. News 70 (1894) 10.  
*Baldwin, C. W.* Phys. Rev. 3 (1896) 370-380; Beibl. (1896) 774.  
*Beckmann.* Ztsch. f. Electrochem. 5 (1899) 327; Beibl. (1899) 778.

- Bohn, C.* Ztsch. f. physikal. Chem. 18 (1895) 219-240; Beibl. (1895) 20-24.
- Bouty, E.* C.-R. 120 (1895) 1260-1262; 122 (1896) 372-374.
- Bunte, H.* Beibl. (1891) 713; (1892) 209.
- . Ber. chem. Ges. 31 (1898) 5-25; Beibl. (1898) 313.
- Burch, G. J.* Nature 35 (1887) 165; Beibl. (1887) 536.
- Chautard, J.* C.-R. 79 (1874) 1123; Jahresb. (1874) 156-157.
- Cochin, D.* C.-R. 116 (1893) 1055-1057; Beibl. (1893) 652.
- Cundall, J. T.* Chem. Centralbl. (4) 1 (1890) 664.
- Ebert, H.* Jahrb. f. Photogr. 5 (1891) 592-600; Beibl. (1891) 280.
- Eder, J. M.* Monatsh. f. Chem. 11 (1890) 151-153; Wiener Anzeiger (1890) 103-105.
- ——. Wiener Anzeiger (1891) 44-47; Beibl. (1893) 204.
- ——. Denkschr. d. Wiener Akad. 60 (1893) 24 pp.; Beibl. (1894) 910-912.
- ——. Ztschr. f. physikal. Chem. 19 (1886) 20-24; Beibl. (1896) 276.
- —— und *E. Valenta*. Denkschr. d. Wiener Akad. 60 (1893) 467-476.
- , ——. Denkschr. d. Wiener Akad. 67 (1898) 12 pp.; Beibl. (1899) 251, 557.
- Fievez, Ch.* Ann. Observat, Bruxelles, 1888, 10 pp.; Beibl. (1888) 246.
- Hallock, W.* Proc. Roy. Soc. (1894) 112-114; Phys. Rev. 2 (1895) 305-307.
- Hartley, W. N.* Proc. Roy. Soc. 54 (1892-1893) 5-7; 56 (1894) 192-193, 199; Beibl. (1893) 1055; (1894) 997-998; Phil. Trans. 185 (1895) 161, 1029, 1041.
- ——. Proc. Roy. Soc. 61 (1897) 217-219.
- Helmholtz, R. von.* Verh. d. physikal. Ges. Berlin 8 (1889) 51-54; Beibl. (1889) 808.
- Kochs, W.* Dingler's pol. J. 278 (1890) 235-240; Beibl. (1891) 141.
- Landstrom, C. J.* Proc. Roy. Soc. 49 (1896) 76-98.
- Leicester, J.* Chem. News 66 (1892) 295.
- Lewes, V. B.* Chem. News 65 (1892) 79-81, 99-101, 125-126; Beibl. (1893) 747.
- ——. Proc. Roy. Soc. 57 (1895) 181, 450-468; Beibl. (1895) 692.
- ——. J. Chem. Soc. 69-70 (1896) 226-243; Beibl. (1896) 367.
- Living, G. D., and J. Dewar.* Phil. Trans. 179 (1888) 27-42; Beibl. (1888) 349.

- Living, G. D., and J. Dewar.* Proc. Roy. Soc. 49 (1891) 217-225.  
Beibl (1891) 514.
- , —. Proc Roy Soc 52 (1892-1893) 117-123, Beibl. (1893)  
1056.
- , —. Cambridge Proc 10 (1899) 38-40; Beibl. (1899) 781.
- Lommel, E.* Sitzb. Muenchener Akad. 20 (1898) 5-10
- Lundstrom, C. J.* Proc. Roy. Soc. 59 (1896) 76-98; Beibl. (1896)  
367.
- Newth, G. S., and H. E. Armstrong.* Nature 49 (1893) 171.
- Salet, G.* C. R. 110 (1890) 282-283; See Leonard, Jahresb (1889)  
311, and A. P. Smith, Chem. News 61 (1890) 292.
- Smith, A. P.* Chem. News 61 (1890) 292-293; Jahresb. (1890) 384;  
Beibl. (1890) 782.
- Smithells, A.* J Chem Soc. 61 (1892) 217-226; Beibl (1892) 361.
- Nature 49 (1893) 86-92, 149-150.
- Manchester Phil Trans. (1894); Beibl. (1894) 998.
- Phil Mag (5) 39 (1895) 122-134; Beibl. (1895) 243.
- J. Chem Soc. 67-68 (1895) 1049-1062, 1149-1163; Beibl  
(1896) 367.
- Roy. Inst. Gr. Brit., March 12, 1897, 9 pp.
- , H. M. Dawson, and H. A. Wilson. Proc. Roy. Soc. 64 (1898)  
142-148.
- and F. Dent. J Chem. Soc 55-56 (1894) 603-611.
- and Ingle, H. J. Chem. Soc 61 (1892) 204-217; Beibl. (1892)  
361.
- Stevens, W. Leconte.* Phil. Mag (5) 27 (1889) 435-439
- Stokes, Sir G. G.* Proc. Roy. Soc. Edinburgh 18 (1890-1891) 263-264.
- Chem. News 63 (1891) 167-168; 64 (1891) 167, 65  
(1892) 90.
- Teclu, N.* J. prakt. Chem. 44 (1891) 246-255; 51 (1895) 145-160;  
56 (1897) 178-180.
- Vogel, O.* Ztsch. anorg. Chem. 5 (1893) 42-62; Beibl. (1894) 84.
- Wiedemann, E., und H. Ebert.* Ann. Phys. n. F. 35 (1888) 209-264.

## FLASH, OR FLICKER, SPECTRUM

- Backhouse, T. W.* Astrophys. J. 8 (1898) 198.
- Nagumvala, K. D.* Astrophys. J. 8 (1898) 121
- Porter, C. T.* Proc Roy. Soc 63 (1898) 347-356

## FLUORESCENCE.

- Berthelot.* C. R. 120 (1895) 797-801
- Bleekrode, J. L., and J. W. Gifford.* Nature 53 (1895) 557.

- Boisbaudran, F. Lecoq de.* C.-R. 105 (1887) 784-788; 106 (1888) 1386-1387, 1708-1710; 110 (1890) 24-28, 67-71; Beibl. (1887) 783; (1890) 285.
- Boudouard, O.* Chem. News 78 (1898) 28.
- Buckingham, E.* Ztsch. f. physikal. Chem. 14 (1894) 129-148; Beibl. (1895) 69.
- Burke, J.* Rept. Brit. Assoc. (1896) 731.
- . Proc. Roy. Soc. 61 (1897) 485-487; Phil. Trans. 191 (1898) 87-104.
- Donath, Br.* Ann. Phys. n. F. 58 (1896) 609-661.
- Dorne, F., und Erdmann, H.* Liebig's Ann. 287 (1894) 230-232.
- Drude, P., und W. Nernst.* Götting. Nachr. (1891) 346-358.
- Edison, E. A.* Electrician 36 (1896) 834-835.
- Fischer, O., und M. Busch.* Ber. chem. Ges. 24 (1891) 1870-1874.
- Habben, Th.* Diss., Marburg; Beibl. (1892) 210.
- Hartley, W. N.* Nature 38 (1888) 474-477; Beibl. (1889) 509.
- . J. Chem. Soc. 63 (1893) 243-256; Beibl. (1894) 341.
- Knoblauch, O.* Ann. Phys. n. F. 54 (1895) 193-220.
- Krone, H. von.* Jahrb. f. Photogr. 10 (1896) 152-160; 11 (1897) 80-87.
- McIlhiney, P. C.* Trans. New York Acad. 16 (1896-1897) 30.
- Meyer, R.* Ztsch. physikal. Chem. 24 (1897) 468-508; Beibl. (1898) 401.
- . Ber. Chem. Ges. 31 (1898) 510-514.
- Noack, K.* Ges. d. Naturwiss. Marburg 12 (1887) 155 pp. (With bibliography.)
- Pawlewski, Br.* Ber. chem. Ges. 31 (1898) 310, 1693.
- Piltchikoff.* C.-R. 122 (1896) 461-462.
- Porcher, Ch.* C.-R. 125 (1897) 409.
- Radiguet.* C.-R. 124 (1897) 179-180.
- Salvioni, E.* Atti Accad. Perugia 8 (1896) 18 pp.; Nuov. Cim. 5 (1897) 63-70.
- Schincaglia, J.* Bologna, 1899, 22 pp.
- Schmidt, G. C.* Ann. Phys. n. F. 58 (1896) 103-130.
- Spies, P.* Verh. d. physikal. Ges. Berlin 15 (1896) 101.
- Trowbridge, C. C.* Annals New York Acad. 11 I (1898) 39-45.
- Villari, E.* Nuov. Cim. (3) 29 (1891) 36-42; Beibl. (1891) 517.
- Voigt, W.* Götting. Nachr. (1896) 184-185; Beibl. (1897) 346.
- Walter, B.* Ann. Phys. n. F. 34 (1888) 316-326; 36 (1889) 502-532.
- Wichmann, A.* Beibl. (1897) 978.
- Wiedemann, E.* Ann. Phys. n. F. 34 (1888) 446-469.



- Wiedemann, E., und G. C. Schmidt. Jahrb. f. Photogr. (1896) 14 15.  
 —, —. Ann. Phys. n. F. 57 (1896) 447-453.  
 —, —. Verh. d. physikal. Ges. Berlin 16 (1897) 37-40.

## FLUORINE.

- Carvallo, E. C.-R. 116 (1893) 1189-1192, 117 (1893) 306, 845;  
 Beibl. (1893) 917, 1046; (1894) 333.  
 Dufet, H. Bull. Soc. min. de France (1893) 31 pp.  
 Gladstone, J. H., and G. Rept. Brit. Assoc. (1890) 772.  
 Lockyer, J. N. Proc. Roy. Soc. 57 (1895) 67-71, 113-120; 58 (1895)  
 192-195; 59 (1896) 4 9, 342 343; Beibl. (1896) 775.  
 Moissan, H. C.-R. 109 (1889) 937-940; Beibl. (1890) 279.  
 —, —. Ann. chim. phys. (6) 24 (1891) 224-282; Beibl. (1892) 27.  
 —, —. C.-R. 120 (1895) 966-969; Proc. Roy. Soc. 58 (1895) 120-  
 122.  
 —, —. Roy. Inst. Gr. Brit., May 28, 1897, 17 pp.; Beibl. (1898)  
 268.  
 Paschen, F. Ann. Phys. n. F. 53 (1894) 301, 812-822; 56 (1895) 762-  
 767.  
 Rubens, H. Ann. Phys. n. F. 51 (1893) 381.  
 —, — und B. W. Snow. Ann. Phys. n. F. 146 (1892) 529.  
 Swarts, F. Bull. Acad. Belg. 34 (1897) 293-307, Beibl. (1898) 150.

## FLUTED SPECTRA.

- Brunhes, B. J. de phys. (2) 10 (1891) 508-512; Beibl. (1892) 435.  
 Poincare, H. C.-R. 120 (1895) 757-762; Beibl. (1895) 788.  
 Schuster, A. C.-R. 120 (1895) 987-989; Beibl. (1895) 788.

## GADOLINITE.

- Bettendorff, A. Liebig's Ann. 270 (1892) 376-383, Beibl. (1892) 744.  
 Boisbaudran, F. Lecoq de. C.-R. 111 (1890) 393-395, 409-411, 472-  
 474.

## GALLIUM.

- Boisbaudran, F. Lecoq de. C.-R. 104 (1887) 1584-1585; 114 (1892)  
 815-818.  
 Gladstone, J. H. Rept. Brit. Assoc. (1892) 679.  
 Hartley, W. N., and H. Ramage. Proc. Roy. Soc. 60 (1896) 35-37.  
 —, —. Dublin Trans. 7 (1898) 6 pp.; Astrophys. J. 9 (1899) 214-  
 220.  
 —, —. Astrophys. J. 9 (1899) 221-228.  
 Jewell, L. E. Astrophys. J. 9 (1899) 229-230; Beibl. (1899) 789.  
 Wilde, H. Proc. Roy. Soc. 52 (1892) 369-372, Beibl. (1893) 1054

## GASES.

- Ames, J. S. *Phil. Mag.* (5) 30 (1890) 48-58; Beibl. (1890) 1099.
- Aubel, E. van. *J. de phys.* (3) 7 (1898) 408-409.
- Baccei, P. *Mem. Spettr. Ital.* 28 (1899) 97-102; 121-129; *Nuov. Cim.* 9 (1899) 177-191, 241-254; Beibl. (1899) 635.
- Beattie, Carruthers, and Smolan. *Phil. Mag.* (5) 48 (1897) 418-439.
- Best, T. W. *Chem. News* 55 (1887) 208-211; Beibl. (1888) 102.
- Blitz, H. *Ztsch. physikal. Chem.* 9 (1892) 152-158.
- Bohn, C. *Ztsch. Phys. u. Chem.* 18 (1895) 219-240.
- Brandsept, A. *Soc. franç. de phys.* (1893) 284-290.
- Carnazzi, P. *Nuov. Cim.* 6 (1897) 385-401; Beibl. (1898) 661.
- Chappuis, J. *C.-R.* 114 (1892) 286-288; Beibl. (1892) 425.
- Corrigan, S. J. *Astron. and Astrophys.* (1892) 108-119.
- Dudley, W. L. *Chem. News* 66 (1892) 163-165; Beibl. (1893) 123, 206.
- Ebert, H. *Ann. Phys. n. F.* 36 (1889) 466-473.
- Eder, J. M., und Valenta, E. *Denkschr. d. Wiener Akad.* (1898) 12 pp.
- Evershed, J. *Phil. Mag.* (5) 39 (1895) 460-476; Beibl. (1895) 882.
- Ferry, E. S. *Phys. Rev.* 7 (1898) 1-10; 296-306; Beibl. (1898) 900; (1899) 251.
- Fitzgerald, G. F. *Proc. Roy. Soc.* 57 (1895) 312-314.
- Franklin, W. S. *Sci. n. s.* 9 (1899) 594-595.
- Giesel, F. *Ber. chem. Ges.* 30 (1897) 156-158; Beibl. (18973) 37.
- Hagenbach, A. *Ann. Phys. n. F.* 60 (1896) 124-133.
- Helmholtz, R. von. (Gekronte Preisarbeit.) Beibl. (1890) 589-602.
- Hemptinne, A. de. *C.-R.* 125 (1897) 428-431; *Bull. Acad. Belg.* 37 (1899) 22-43.
- Henrich, F. *Ztsch. f. physikal. Chem.* 9 (1892) 435-444.
- Hodgkinson, W. R., and F. K. S. Lowndes. *Chem. News* 58 (1888) 187, 223-224.
- Hutchins, C. C. *Amer. J. Sci.* (4) 6 (1898) 61-64.
- Jaeger, G. *Arch. de Genève* (3) 34 (1895) 376-377.
- Janssen, J. *C.-R.* 118 (1894) 757-760, 1007-1009; Beibl. (1894) 751, 837.
- Julius, W. H. Beibl. (1890) 602-615.
- Kelvin, Beattie, Carruthers, and Smolan. *Proc. Roy. Soc. Edinb.* 21 (1897) 393-428.
- Killing, C. *Naturwiss. Rundsch.* 13 (1898) 69-70; Beibl. (1898) 313.
- Koch, G. R. *Ann. Phys. n. F.* 38 (1889) 213.
- Leicester, J. *Chem. News* 66 (1893) 295; Beibl. (1893) 926.

- Lepsius, R.* Ber. chem. Ges. 23 (1890) 1418-1428, 1637-1642.
- Leaves, V. B.* Chem. News 63 (1891) 3 5, 15-16, 32-33, 40-43; Beibl. (1891) 204.
- — — Chem. News 65 (1892) 79-81, 99-101, 125-126; Beibl. (1893) 747.
- — — Chem. News 71 (1895) 190-192, 203-205; Proc. Roy. Soc. 57 (1895) 450-468.
- Lewers, P.* Astrophys. J. 10 (1899) 137-163.
- Lockyer, J. N.* Proc. Roy. Soc. 59 (1895) 1-4.
- — — Proc. Roy. Soc. 57 (1895) 67 71, 113-120; 58 (1895) 192, 193-195; 59 (1896) 4 9, 342 343. Beibl. (1896) 271-273.
- — — C.-R. 120 (1895) 1103 1105; Beibl. (1895) 566.
- Meldola, R.* Sci. Amer., Suppl. 40 (1895) 16554.
- Mewes, R.* Ztsch. f. komprom u fluss. Gase 1 (1897) 90-94; 2 (1898) 136-142, 164-166; Beibl. (1898) 144.
- Nasini, R.* Gazz. chim. Ital. 22 (1890) 190-220.
- Newall, H. F.* Proc. Cambridge Phil Soc. 9 (1897) 295-303. Beibl. (1898) 172.
- Parry, J.* Beibl. (1890) 853.
- Paschen, F.* Ann. Phys. n. F. 50 (1893) 409; 51 (1894) 1; 52 (1894) 209.
- Paner, J.* Ann. Phys. n. F. 61 (1897) 363-370.
- Perreau, F.* J. de phys. (3) 4 (1895) 411 416. Ann. chim. phys. (7) 7 (1896) 289-348.
- Pringsheim, E.* Ann. Phys. n. F. 45 (1892) 428, 49 (1893) 347, 51 (1894) 441.
- Ramsay, W.* London: McMillan, 1896, 240 pp. (History, with portraits.)
- — and M. W. Travers. Rept. Brit. Assoc. (1897) 587 588.
- — — Proc. Roy. Soc. June 3, 1898. Astrophys. J. 8 (1898) 120-122.
- Rayleigh, Lord.* Phil. Mag. (5) 32 (1891) 424-445.
- Righi, A.* Rend. Accad. Roma 5 (1889) 860 862.
- — — Rend. Accad. Roma 4 (1895) 203-207.
- — — Rend. Accad. Bologna, 1899, 27 pp. Nuov. Cim. 10 (1899) 20-42, 112-115.
- Sagnac, G.* C.-R. 125 (1897) 168-171.
- Schuster, A., and Lord Rayleigh.* Rept. Brit. Assoc. (1895) 610.
- Siertsema, L. H.* Zitt. Akad. Amsterdam 7 (1898) 289 297.
- Simon, E.* Sitzb. Wiener Akad. 104 II (1895) 565-593.
- Smithells, A.* Phil. Mag. (6) 37 (1894) 245-259. Beibl. (1895) 68.

- Smithells, A.* (*Cont'd*). *Phil. Mag.* (5) 39 (1895) 122-134; *Beibl.* (1895) 243.
- Smolan, R. S. de.* *Chem. Centralbl.* 2 (1899) 353.
- Smyth, C. P.* *Chem. News* 60 (1889) 223-224; *Beibl.* (1890) 119.
- Stoney, G. J.* *Dublin Trans.* (2) 4 (1891) 563-608; *Beibl.* (1892) 531.
- —. *Dublin Trans.* (2) 4 (1892) 563-608.
- —. *Phil. Mag.* (5) 40 (1895) 362-393.
- Thomson, J. J.* *Proc. Roy. Soc.* 58 (1895) 1; *Astrophys. J.* 2 (1895) 394-395.
- Tilden, W. A.* *Proc. Roy. Soc.* 60 (1897) 453-457.
- Travers, M.* *Chem. News* 78 (1898) 317-318.
- Troost, L., et L. Ouvrard.* *C.-R.* 121 (1895) 798-800.
- Trowbridge, J., and Richards, T. W.* *Phil. Mag.* (6) 43 (1897) 135-139; *Astrophys. J.* (1897) 150.
- Vicentini.* *Rend. Accad. Roma* (5) 1 (1892) 143-149, 235-241.
- Villard, P.* *Ann. chim. phys.* (7) 10 (1897) 387-432.
- Villari, E.* *Rend. Accad. Roma* 6 (1897) 91-101; *Nuov. Cim.* 5 (1897) 459-466.
- Vogel, H. W.* *Photogr. Mittheil.* 29 (1892) 302-304; 383-385; *Beibl.* (1893) 748, 925.
- —. *Photogr. Mittheil.* 31 (1894) 314-315, 361-369; *Beibl.* (1895) 242, 422.
- Warburg, E.* *Ann. Phys. n. F.* 54 (1895) 265-275.
- Wesendonck, K.* *Naturwiss. Rundsch.* 12 (1897) 288-290.
- Wiedemann, E., und H. Ebert.* *Ann. Phys. n. F.* 35 (1888) 209-264.
- — und *G. C. Schmidt.* *Naturwiss. Rundsch.* 11 (1896) 429-432.
- Wilson, C. T. R.* *Proc. Roy. Soc.* 64 (1898) 127-130; *Chem. News* 78 (1898) 281, Abs.
- Wind, C. H.* *Sitzb. Wiener Akad.* 106 II (1897) 21-32.
- Winkelmann, A.* *Ann. Phys. n. F.* 32 (1887) 439-442.
- Winkler, L. W.* *Ztsch. f. physikal. Chem.* 9 (1892) 171-176.
- Wüllner, A.* *Sitzb. Berliner Akad.* (1889) 793-812; *Ann. Phys. n. F.* 38 (1889) 619-640.

## GERMANIUM.

- Humphreys, W. J.* *Astrophys. J.* 6 (1897) 169-232.
- Rowland, H. A., and R. K. Tatnall.* *Astrophys. J.* 1 (1895) 14-17, 149-153; *Beibl.* (1895) 422; (1896) 29.
- Winckler, Cl.* *Ber. chem. Ges.* 19 (1886) 210.

## GLASS.

- Boumann, Z. P.* Zitt Akad. Amsterdam 5 (1896) 438-442.  
*Conroy, J.* Phil. Trans. 180 A (1889) 245-287; Beibl. (1890) 115.  
 ——. Phil. Mag (5) 31 (1891) 317-320, Beibl. (1891) 516.  
*Cornu, A.* C.-R. 108 (1889) 1211-1217.  
*Eder, J. M., und E. Valenta* Jahrb. f. Photogr. (1895) 310-327;  
 Beibl. (1895) 61-64.  
*Foerster, F.* Ber. chem. Ges. 25 (1892) 2494 2518.  
*Nichols, E. L.* Phys. Rev. 2 (1895) 267.  
 — — — and *B. W. Snow.* Phil. Mag (5) 33 (1892) 379-381, Beibl.  
 (1892) 608.  
*Petinelli, P.* Nuov. Cim. (4) 2 (1895) 156-159; Beibl. (1896) 309  
*Radiguet, C.-R.* 124 (1897) 179-180.  
*Sandrucci, A.* Nuov. Cim. 6 (1897) 322-325.  
*Sternung, W.* Beibl. (1887) 340.  
*Weber, R., und E. Sauer.* Ber. chem. Ges. 25 (1892) 1814 1810

## GLUCIUM. See BERYLLIUM.

## GOLD.

- Boisbaudran, F. Lecoq de.* C.-R. 124 (1897) 1288-1290, Beibl. (1897)  
 735.  
*Demarçay, E.* C.-R. 106 (1888) 1228-1229; Beibl. (1888) 581.  
*Eder, J. M., und E. Valenta.* Denkschr. d. Wiener Akad. (1896)  
 47 PP.  
*Ferner F., und Haschek, E.* Wien: Gerold's Sohn, 1898; Wiener An-  
 zeiger (1898) 13-19.  
*Hoffmann, L., und G. Kruess.* Ber. chem. Ges. 20 (1887) 2369-2376.  
*Humphreys, W. J.* Astrophys. J. 6 (1897) 169-232.  
*Kayser, H., und Runge, C.* Ann. Phys. n. F. 46 (1892) 225.  
*Kruess, G.* Ber. chem. Ges. 20 (1887) 2365-2368; Liebig's Ann. 238  
 (1887) 30-77, 241-275.  
*Schottlaender, P.* Liebig's Ann. 240 (1887) 346; Jahresb. 605.  
*Smithells, A.* Phil. Mag. (5) 39 (1895) 122 134; Beibl. (1895) 243.

## H LINES.

- Hale, G. E.* C.-R. 116 (1893) 170-173; Astrophys. J. 6 (1897) 157.  
*Jewell, L. E.* Johns Hopkins Univ. Cir. 17 (1898) 62-63; Astrophys.  
 J. 8 (1898) 51-53.

## HARMONIC SERIES.

- Lépinay, J. Macé de.* J. de phys. 8 (1899) 137-148.  
*Runge, C.* Rept. Brit. Assoc. (1888) 576; Beibl. (1890) 509.

*Rydberg, J. R.* Verh. deutsch. Naturf. u. Aerzte (1896) 34.

*Schuster, A.* Proc. Roy. Soc. 31 (1880-1881) 337; Jahresb. (1881) 122.

*Thiele, T. N.* Astrophys. J. 6 (1897) 65-76; Beibl. (1898) 34.

## HEAT SPECTRA.

*Ångström, K.* Nova acta sci. Upsala 8 (1887) 1-17; Jahresb. (1888) 320.

———. Ann. Phys. n. F. 36 (1889) 715-725.

*Aymonnet.* C.-R. 113 (1891) 418-421; Beibl. (1891) 430.

———. C.-R. 119 (1894) 50-53, 151-154; Beibl. (1894) 908; (1895) 64.

———. C.-R. 121 (1895) 1139-1141; Beibl. (1896) 537.

*Berthelot, D.* C.-R. 126 (1898) 410-412.

*Beuriger.* (Historische Uebersicht.) Beibl. (1898) 155.

*Bonacini, C.* Mem. Spettr. Ital. 23 (1894) 146-154.

*Bottomley, J. T.* Proc. Roy. Soc. 42 (1887) 357-359, 433-437; Beibl. (1887) 701; (1888) 344.

———. Proc. Roy. Soc. 52 (1892) 162-163; Beibl. (1893) 121.

———. Phil. Trans. 184 (1893) 591-646; Beibl. (1894) 336.

*Boumann, Z. P.* Zitt. Akad. Amsterdam 5 (1896) 438-442.

*Carvallo, E.* C.-R. 112 (1891) 431, 521.

———. C.-R. 116 (1893) 1189-1192; 117 (1893) 306-307, 845; Beibl. (1893) 917, 1046.

———. Soc. franç. de phys. (3) 2 (1893) 27-36; Beibl. (1893) 562.

———. Ann. chim. phys. (7) 4 (1895) 5-79; Beibl. (1895) 566.

*Conroy, J.* Phil. Mag. (5) 31 (1891) 317-320; Beibl. (1891) 516.

*Crova, A., et Houdaille.* C.-R. 108 (1889) 35-39; Beibl. (1889) 219, 289.

———. C.-R. 114 (1892) 941-943.

*Eder, J. M.* Wiener Anzeiger (1890) 103-105.

——— und *Valenta, E.* Denksch. d. Wiener Akad. (1894) 19 pp.

*Ferrel, W.* Amer. J. Sci. (3) 39 (1890) 137-145; Beibl. (1890) 981-982.

*Friedel, Ch.* Ann. Phys. n. F. 55 (1895) 453-478.

*Frohlich, O.* Ann. Phys. n. F. 30 (1887) 582-620.

*Godard, L.* C.-R. 106 (1888) 545-547; Beibl. (1888) 344.

*Hutchins, C. C.* Amer. J. Sci. (3) 43 (1892) 558-559; Beibl. (1892) 666.

*Janssen, J.* C.-R. 118 (1894) 757-760, 1007-1009; Beibl. (1894) 751, 837.

- Julius, W. H. Beibl (1896) 27.  
 Kurlbaum, F. Ann Phys n. F. 51 (1894) 591.  
 Lachowicz, Br. Ber. chem. Ges. 20 (1887) 735-743; Beibl. (1887) 708.  
 Lorentz, H. A. Zitt. Akad. Amsterdam (1895-1896) 305-311, Beibl. (1897) 29.  
 Mach, E. Ztsch. phys chem Unterr. 7 (1894) 113; Beibl. (1894) 837.  
 Maurer, J. Repert. d Phys. 25 (1889) 642-654; Beibl (1890) 375.  
 Offret, A. Bull. Soc. min. de France 13 (1890) 405-688; Beibl (1891) 565.  
 Perrigot, C.-R. 124 (1897) 857-859.  
 Pettinelli, P. Riv. Sci. industr. 27 (1895) 121-123; Beibl. (1895) 784.  
 Rizzo, G. B. Atti Accad. Torino 26 (1890-1891) 442-448; Mem. Spettr. Ital. 27 (1898) 10-32.  
 Rubens, H. Verh. deutsch. Naturf. u. Aerzte (1897) 54-56.  
 — — und Ashkinass, E. Ann. Phys. n. F. 64 (1898) 602-605.  
 — — Verh. deutsch. physikal. Ges. 1 (1899) 11-12.  
 — — und Nichols, E. F. Ann. Phys. n. F. 60 (1897) 418-462.  
 Tereschin, C. J. Russ. phys. chem. Ges. 29 (1897) 169-176; Beibl. (1898) 312.  
 Thomas, L. et Ch. Trepied. C.-R. 109 (1889) 524-525; Beibl. (1890) 39.  
 Tumlirz, O., und A. Krug. Sitzb. Wiener Akad. 97 II (1889) 1521-1559.

## HELIUM

- Ames, J. S., and Humphreys, W. J. Astrophys. J. 5 (1897) 97-98.  
 Barly, E. C., Ramsay, N., and Travers, M. W. Nature 58 (1898) 545.  
 Belopolsky, A. Mem. Spettr. Ital. 23 (1894) 89. Beibl. (1895) 422.  
 Berthelot, C.-R. 120 (1895) 660.  
 — C.-R. 124 (1897) 113 119.  
 Boisbaudran, F. Lecoq de C.-R. 120 (1895) 1097-1104.  
 Bouchard, C. C.-R. 121 (1895) 392-394.  
 Cleve, P. F. C. R. 120 (1895) 834-835, 1212, Beibl (1895) 568.  
 Collie, J. N., and W. Ramsay. Proc. Roy Soc 59 (1896) 257-270.  
 Crookes, W. Chem. News 72 (1895) 87-89; Astrophys J 2 (1895) 227-234; Beibl. (1895) 883.  
 — — Ztsch. anorg. Chem. 11 (1896) 6-13; Beibl. (1896) 275.  
 — — Proc. Roy. Soc 63 (1898) 408 411.  
 — — Nature 58 (1898) 570.



- Dewar, J.* Proc. Roy. Soc. 63 (1898) 256-258; Beibl. (1898) 515-516.  
*Frost, E. B.* Astrophys. J. 2 (1895) 383-384; Pub. A. S. Pac. 7 (1895) 317-326.  
*Hale, G. E.* Astrophys. J. 2 (1895) 76.  
*Hill, E. A.* Amer. J. Sci. (3) 49 (1895) 359-377.  
*Huggins, W.* Chem. News 72 (1895) 26-27, 89.  
 ——. Chem. News 71 (1895) 283; Beibl. (1895) 634.  
*Kayser, H.* Chem. News 72 (1895) 89.  
*Kuenen, J. P., and W. W. Randall.* Proc. Roy. Soc. 59 (1896) 60-66.  
*Langlet, N. A.* Ztsch. anorg. Chem. 10 (1895) 289-293.  
*Lockyer, J. N.* Nature 51 (1895) 586; 53 (1896) 319-322, 342-346.  
*McClean, F.* Proc. Roy. Soc. 62 (1898) 417-423; Astrophys. J. 7 (1898) 367-372.  
*MacGowan, G.* Knowledge 18 (1895) 210-213.  
*Maunder, E. W.* Knowledge 19 (1896) 284-287.  
*Mohler, J. F., and L. F. Jewell.* Astrophys. J. (1896) 351-355.  
*Moureau, C.* C.-R. 121 (1895) 819-820.  
*Olszewski, O.* Ann. Phys. n. F. 59 (1896) 184-192; Nature 54 (1896) 377-378.  
*Palmer, De F.* Amer. J. Sci. (3) 50 (1895) 357-359; Beibl. (1896) 197.  
*Palmieri, L.* Napoli Rend. (3) 3 (1895) 121; Beibl. (1896) 531.  
*Ramsay, W.* Proc. Roy. Soc. 57 (1895) 65-67.  
 ——. Proc. Roy. Soc. 57 (1895) 65-67, 81-89; 58 (1895) 81-89; 59 (1896) 325-330; 60 (1896) 53-56; 62 (1898) 225-232; 316-324; 325-329.  
*Rayleigh, Lord.* Chem. News 72 (1895) 152; Proc. Roy. Soc. 59 (1896) 198-208.  
*Runge, C.* Chem. News 71 (1895) 283; Beibl. (1895) 634.  
 ——. und *F. Paschen.* Sitzb. Berliner Akad. (1895) 639-643.  
 ——. Nature 52 (1895) 544; 53 (1895) 245; Beibl. (1897) 633.  
*Thomsen, J.* Ztsch. physikal. Chem. 25 (1898) 112-114; Beibl. (1898) 267.  
*Tilden, W. A.* Proc. Roy. Soc. 59 (1896) 218-224.  
*Travers, M. W.* Proc. Roy. Soc. 60 (1897) 449-453.  
*Troost, L., et L. Ouvrard.* C.-R. 121 (1895) 394-396, 798-800.  
*Wilde, H.* Phil. Mag. (5) 39 (1895) 466-472; 40 (1895) 466-471.

## HEMOGLOBIN.

- Bertin-Sans, H.* C.-R. 106 (1888) 1243-1245.  
*Gamgee, A.* Arch. de Genève (3) 34 (1895) 585-586; Beibl. (1896) 696.

*Harris, D. F.* Proc. Roy. Soc. Edinburgh 22 (1898) 187-208; Beibl. (1899) 252.

*Krueger, F.* Ztsch. f. Biol. 24 (1888) 47; Jahresb. (1888) 2413.

## HOLMIUM.

*Forstling, S.* Bih. Svensk. Akad. Handl. 24 II (1898) 1-35.

HYDROGEN. (Look also under *Water*.)

*Arno* Atti Accad. Torino 31 (1895-1896) 418-421.

*Bauer, P.* Mem. Spettr. Ital. 28 (1899) 121-129; Beibl. (1899) 636.

*Bancroft, W. D.* J. physikal. 2 (1898) 496-498.

*Bruchl, J. W.* Ber. chem. Ges. 30 (1897) 162-172.

*Campbell, W. W.* Astron. Nachr. 134 (1893) 133-134; Beibl. (1894) 565.

— — —. Astrophys. J. 2 (1895) 177-184; Beibl. (1896) 372.

— — —. Astrophys. J. 9 (1899) 312.

*Cook, C. S.* Amer. J. Sci. (3) 39 (1890) 258; Beibl. (1890) 782.

*Deslandres, H.* C.-R. 106 (1888) 842; 112 (1891) 663.

— — —. C. R. 115 (1892) 222-225.

*Dewar, J.* Proc. Chem. Soc. (1898) 146; Beibl. (1898) 515.

— — —. Proc. Roy. Soc. 64 (1899) 231-238; Beibl. (1899) 415.

*Eder, J. M.* Monatsh. f. Chem. 11 (1890) 151-153; Beibl. (1890) 780.

*de Forcrand et Sully, Thomas.* C.-R. 125 (1897) 109-111.

*Gruenwald, A.* Chemikerztng. 14 (1890) 4 pp.

— — —. Astron. Nachr. (1887) 201-214; Beibl. (1888) 245-246.

— — —. Monatsh. f. Chem. 11 (1890) 129; 13 (1892) 111-244; Beibl. (1893) 203.

*Hagenbach, Ed.* Beibl. (1887) 339.

*Hartley, W. N.* Proc. Roy. Soc. 54 (1892-1893) 5-7; Beibl. (1893) 1055.

*Hartmann, L. W.* Phys. Rev. 9 (1899) 176-189.

*Herschel, A. S.* Observ. 19 (1896) 232-234.

*Hutton, R. S.* Phil. Mag. (5) 46 (1898) 338-343. (Bibliography of the H Spectrum.)

*Irwin, W.* J. Chem. Soc. 16 (1897) 296-297; Beibl. (1897) 862.

*Janssen, J.* C.-R. 121 (1895) 233-237; Beibl. (1896) 36.

*Jewell, L. E.* Astrophys. J. 4 (1896) 324-342; 5 (1897) 279-281; 9 (1899) 211-214.

*Jones, A.* Diss. Erlangen 1896, 29 pp.; Ann. Phys. n. F. 62 (1897) 30-53.

*Kayser, H.* Astrophys. J. 5 (1897) 243.

- Keeler, J. E.* Astrophys. J. 4 (1896) 137; 8 (1898) 113.
- Klimenko, E., und G. Pekatoros.* Chem. Centralbl. (4) 1 (1890) 570.
- Kuenen, J. P., and W. W. Randall.* Proc. Roy. Soc. 59 (1896) 60-66.
- Liveing, G. D., and Dewar, J.* Proc. Roy. Soc. 43 (1887) 340-347; Beibl. (1888) 349.
- —. Phil. Trans. 179 I (1888) 27-42.
- —. Phil. Mag. (5) 34 (1892) 371-374; Beibl. (1893) 925.
- MacGregor, J. G.* Canada Roy. Soc. Proc. 9 (1891) 27-42; Beibl. (1893) 123.
- Moissan, H., et Ch. Moureau.* C.-R. 122 (1896) 1240-1243.
- Pickering, E. C.* Astrophys. J. 7 (1898) 139; Harvard Observ. Cir. 21 (1897).
- Politzine, A.* Bull. Soc. chim. Paris (3) 6 (1891) 264-266.
- Ramsay, W., and M. W. Travers.* Proc. Roy. Soc. 62 (1898) 225-232; Beibl. (1898) 217.
- Rayleigh, Lord.* Chem. News 62 (1890) 1-4, 17-19.
- Richards, Th. W.* Chem. News 79 (1899) 159-160.
- Richardson, A.* J. Chem. Soc. (1887) 801-806.
- Rubens, H., und E. Ashkinass.* Ann. Phys. n. F. 64 (1898) 1; Astrophys. J. 8 (1898) 176-192.
- , —. Ann. Phys. n. F. 64 (1898) 584-601.
- Sabatier, P.* C.-R. 118 (1894) 1042-1043, 1144-1146, 1260-1263; Beibl. (1894) 1048.
- Scheiner, J.* Astrophys. J. 7 (1898) 231-238.
- Schumann, V.* Astron. and Astrophys. 12 (1893) 159-166; Beibl. (1893) 826.
- —. Jahrb. f. Photogr. u. Reprod. 8 (1894) 752.
- Smithells, A.* J. Chem. Soc. 67-68 (1895) 1049-1062, 1149-1163; Beibl. (1896) 367.
- Spaulden, E.* Photogr. Mittheil. 32 (1895) 6-11.
- Spring, W.* Ztsch. f. anorg. Chem. 8 (1895) 424-434.
- Stscheglaiew, J.* Ann. Phys. n. F. 64 (1898) 325-332; 65 (1898) 745.
- Sundell, A. E.* Phil. Mag. (5) 24 (1887) 98.
- Thomas, L., et C. Trepied.* C.-R. 109 (1889) 524-525.
- Traube, J.* Ber. chem. Ges. 30 (1897) 38-43; Beibl. (1897) 510.
- Trowbridge, J., and Sabine, W. C.* Phil. Mag. (5) 27 (1889) 139-140; Beibl. (1889) 678.
- Vogel, H. C.* Nature 49 (1893) 162; Astr. Nachr. 134 (1894) 95-96; Beibl. (1894) 670.
- Wilsing, J.* Astrophys. J. 10 (1899) 269-271.
- Wullner, A.* Sitzb. Berliner Akad. (1889) 1113-1119.

## INDIUM.

- Gladstone, J. H.* Rept. Brit. Assoc. (1892) 679  
*Humphreys, W. J.* Astrophys. J. 6 (1897) 169-232  
*Kayser, H., und C. Runge* Ann. Phys. n. F. 48 (1893) 126  
*Wilde, H.* Proc. Roy. Soc. 52 (1892-1893) 369-372; Beibl. (1893) 1054.

## INFRA-RED.

- Carnallo, E.* C.-R. 114 (1892) 288-291; Beibl. (1892) 672.  
 ——. C.-R. 126 (1898) 728-731; 950-953; Beibl. (1899) 31.  
*Dongier, R.* C.-R. 125 (1897) 228-230; 126 (1898) 1627-1628; Ann. chim. phys. 13 (1898) 331-391.  
*Draper, D.* Rept. Brit. Assoc. (1885) 935; Beibl. (1888) 193.  
*Hallock, W.* Sci. 2 (1895) 174-178 (Bolometric investigations).  
*Julius, W.* Arch. Néerland. 22 (1887) 310-383; Beibl. (1889) 307.  
*Keeler, J. E.* Astrophys. J. 3 (1896) 63-77.  
*Langley, S. P.* Rept. Brit. Assoc. (1894) 465-474; Beibl. (1894) 1045.  
 ——. Phil. Mag. (5) 26 (1888) 505; Amer. J. Sci. (3) 36 (1888) 397.  
*Lewis, E. P., and E. S. Ferry.* Johns Hopkins Univ. Cir. 12; Beibl. (1895) 242.  
 ——. Johns Hopkins Univ. Cir. 14 (1895) 70-71; Beibl. (1895) 784.  
 ——. Astrophys. J. (1895) 1-25, 106-108; Beibl. (1896) 28.  
*Merritt, E.* Phys. Rev. 2 (1895) 424-442.  
*Moreau, G.* Ann. chim. phys. (7) 1 (1884) 227-259.  
*Nichols, E. F.* Phys. Rev. 1 (1893) 1-18; Beibl. (1893) 1062.  
 ——. Phys. Rev. 4 (1897) 297-313.  
*Nodon, A.* Éclair. élect. 8 (1896) 321-322.  
*Rigollot, H.* C.-R. 121 (1895) 164-166; Beibl. (1895) 891.  
*Snow, B. W.* Phys. Rev. 1 (1893) 221-223; Beibl. (1894) 912.  
*Very, F. W.* Astrophys. J. 2 (1895) 237.

## INTENSITY OF THE SPECTRUM

- Abney, W. de W., and E. Festing.* Proc. Roy. Soc. 40 (1886) 378-380.  
 ——. Phil. Mag. (5) 27 (1889) 62-69.  
*Basso, G.* Nuov. Cim. 5 (1886) 210-226.  
*Becquerel, H.* C.-R. 113 (1891) 618-623; Beibl. (1892) 432.  
*Bartoli, A.* Beibl. (1891) 418.  
*Brennand, W.* Proc. Roy. Soc. 40 (1891) 4-11; Beibl. (1891) 355.  
*Ebert, H.* Ann. Phys. n. F. 32 (1887) 337-384.

- Ferrel, W.* Amer. J. Sci. (3) 41 (1891) 378-386; Beibl. (1891) 645.  
*Fievez, C., et E. Aubel.* Soc. franç. de phys. (1889) 2-3.  
*Henry, Ch.* C.-R. 123 (1896) 452-454.  
*Jewell, L. E.* Astron. and Astrophys. 12 (1893) 815-821.  
*Koenig, A.* Ann. Phys. n. F. 45 (1892) 604.  
 ——. Sitzb. Berliner Akad. 39 (1897) 871-882.  
 ——. und *C. Dieterici.* Ztsch. f. Psychol. u. Physiol. 4 (1892) 241-347.  
*Mengarini, G.* Atti Accad. Roma 3 (1887) 482-489, 566-573; Beibl. (1887) 705; (1888) 663.  
*Provenzali, P. F. S.* Atti. Accad. Roma 45 (1892) 29-35.  
*Rayleigh, Lord.* Phil. Mag. (5) 34 (1892) 309-320; Beibl. (1893) 833.  
 Reports on Solar Radiation, See Repts. Brit. Assoc.  
*Teclu, N.* J. prakt. Chem. n. F. 47 (1893) 568-584; Beibl. (1893) 919.  
*Vogel, H. W.* Verh. d. physikal. Ges. Berlin 10 (1891) 35-46; Beibl. (1891) 560.  
*Walter, B.* Ann. Phys. n. F. 36 (1889) 502-516.  
*Uhthoff, W.* Verh. d. physikal. Ges. Berlin 8 (1889) 9-12.

## INTERFERENCE.

- Barus, C.* Amer. J. Sci. (4) 3 (1897) 107-117.  
*Benoit, R.* Soc. franç. de phys. (1897) 95-106.  
*Berthelot, D.* C.-R. 126 (1898) 410-412.  
*Blasius, E.* Ann. Phys. n. F. 45 (1892) 316, 385.  
*Bonacini, C.* Beibl. (1895) 71.  
*Borgesius, A. H.* Beibl. (1895) 221-243; Amsterdam Akad. Froh. 3 (1895) 99-104.  
*Boulouch, R.* J. de phys. (3) 2 (1893) 316-320; Beibl. (1894) 194.  
 ——. J. de phys. (3) 3 (1894) 28-31.  
*Branly, E.* J. de phys. 7 (1888) 69-72.  
*Cantone, M.* Nuov. Cim. (3) 23 (1888) 59-64; Beibl. (1889) 20.  
*Comstock, G. C.* Astrophys. J. 5 (1897) 26-35.  
*Croua, A.* C.-R. 116 (1893) 672-674; Beibl. (1894) 193.  
*Ebert, H.* Ann. Phys. n. F. 34 (1888) 39-91. See Exner, Do. 35 (1888) 400.  
*Ekstrom, A.* Ann. Phys. n. F. 64 (1898) 315-324.  
*Fabry, Ch.* C.-R. 110 (1890) 455-457; 111 (1890) 600-602, 788-790.  
 ——. Thèse, Fac. des Sci., Paris 1892, 100 pp.; Beibl. (1892) 668; (1893) 341.  
 ——. et *A. Perot.* Ann. chim. phys. (7) 12 (1897) 459-501; Beibl. (1898) 565-567.

- Fabry, Ch., et A. Perot* C.-R. 126 (1898) 1561-1564, 1624-1626;  
Beibl (1899) 30.  
—, — Ann. chim. phys. (7) 16 (1899) 115-144.  
*Gouy* C.-R. 120 (1895) 1039-1041; Beibl (1896) 277.  
*Grosse, W.* Ztsch. phys. u. chem. Unterr. 3 (1890) 171-177, 269-277;  
Beibl (1891) 356.  
*Hale, G. E.* Astrophys. J. 1 (1895) 435-438. See Michelson, Smith-  
son. Contrib. No. 842.  
*Hallwachs, W.* Ann. Phys. n. F. 55 (1895) 282-287, 412.  
*Hamy, M.* C.-R. 124 (1897) 749-752; 126 (1898) 1772-1775.  
*Hull, G. F.* Phys. Rev. 5 (1897) 231-247.  
*Hurion, A.* J. de phys. (3) 1 (1892) 414-424; Beibl (1893) 341.  
*Jaumann, G.* Sitzb. Wiener Akad. 106 IIa (1897) 533-550; Ann.  
Phys. n. F. 64 (1898) 262-278.  
— — Sitzb. Wiener Akad. (1898) 98 pp.; Wiener Anzeiger (1898)  
183-185.  
*Joubin, P.* J. de phys. (2) 9 (1890) 185-191; Beibl (1890) 623.  
*Julius, V. A.* Arch. Néerland. 29 (1896) 454-465; Beibl (1896) 539.  
*Koenig, W.* Ann. Phys. n. F. 55 (1895) 1-43.  
*Lang, V. von* Sitzb. Wiener Akad. 104 IIa (1895) 980-993; 105 IIa  
(1896) 253-262.  
*Lépinay, J. Macé de* C. R. 109 (1889) 137-139; Beibl (1890) 121.  
— — — C.-R. 109 (1889) 893-895; J. de phys. (2) 9 (1890) 121-  
135, 180-185, 376-381; Beibl (1890) 286; (1891) 648.  
— — — et *Ch. Fabry*. C.-R. 110 (1890) 895-898; 997-1000; J.  
de phys. (2) 10 (1891) 5-20; Beibl (1890) 799, 989; (1891) 356.  
— — — C.-R. 116 (1893) 312-315; Beibl (1893) 934.  
— — — J. de phys. (3) 3 (1894) 163-168; Beibl (1894) 1001-  
1002.  
— — — C.-R. 118 (1894) 585-588, 856-859; Beibl (1894) 769.  
*Liebis, Th.* Gött. Nachr. (1893) 265-266; Beibl (1894) 575.  
*Lippmann, G.* J. de phys. (3) 3 (1894) 97-107; Beibl (1894) 761.  
*Lommel, E.* Sitzb. Muenchener Akad. (1888) 319-320, 325-336;  
Beibl (1889) 733-743.  
— — — Ann. Phys. n. F. 50 (1893) 325.  
*Mach, L.* Beibl (1893) 834; (1894) 673; Sitzb. Wiener Akad. (1892)  
5-10; (1893) 1035-1056.  
*Mascart, C.-R.* 108 (1889) 591-597; J. de phys. 8 (1889) 445-451;  
Beibl (1889) 693.  
— — — et *Bouasse*. C.-R. 111 (1890) 83-84; Beibl (1890) 905.  
— — — C.-R. 112 (1891) 407-411; Beibl (1891) 519.

- Mascart (Cont'd)*. Soc. franç. de phys. (1892) 4-5, 509-516; (1893) 18-25; Beibl. (1893) 836.
- Meslin, G.* C.-R. 116 (1893) 250-253, 377-379, 379-383, 570-572; Beibl. (1894) 198-199.
- . C.-R. 117 (1893) 225-228, 339-342, 482-485, 853-856; 119 (1894) 214-217; Beibl. (1894) 175, 198, 199, 568, 570, 1001.
- Michelson, A. A.* Amer. J. Sci. (3) 39 (1890) 216-218; Beibl. (1890) 803.
- . Phil. Mag. (5) 30 (1890) 1-21; 31 (1891) 338-346; 34 (1892) 280-299; Smithson. Contrib. No. 842; Beibl. (1890) 804; (1894) 85.
- . Phil. Mag. (5) 31 (1891) 256-259; Beibl. (1891) 521.
- . Soc. franç. de phys. (1893) 3-5, 155-172.
- Moll, D. P.* Beibl. (1898) 36.
- Morley, E. W., and W. A. Rogers.* Phys. Rev. 4 (1896-1897) 1-22, 106-127.
- Nobert, F. A.* Ann. Phys. 85 (1852) 570; Jahresb. (1852) 134.
- Perot, A., et Fabry, Ch.* C.-R. 126 (1898) 34-36, 407-410.
- . Ann. chim. phys. 16 (1899) 289-338; Astrophys. J. 9 (1899) 87-115.
- Pockels, Fr.* Gött. Nachr. (1890) 259-278.
- Poynting, J. H.* Proc. Birmingham Soc. 7 (1890) 210-219; Beibl. (1891) 562.
- Rayleigh, Lord.* Phil. Mag. (5) 27 (1889) 189-206, 484-486; 28 (1889) 77-91, 189-206; Beibl. (1889) 697; (1890) 42.
- . Phil. Mag. (5) 27 (1889) 298-304; Beibl. (1889) 695.
- . Phil. Mag. (5) 34 (1892) 407-410; Beibl. (1893) 835.
- . Nature 48 (1893) 212-214.
- . Rept. Brit. Assoc. (1893) 703-704.
- Schmidt, E.* Ann. Phys. n. F. 46 (1892) 1.
- Schuster, A.* Phil. Mag. (6) 37 (1894) 509-546; Beibl. (1894) 999.
- Schwarzschild, K.* Astron. Nachr. 139 (1896) 353-360; Beibl. (1897) 344.
- Shedd, J. C.* Phys. Rev. 9 (1899) 1-20, 86-116.
- Sirks, J. L.* Beibl. (1894) 457, 458.
- Stevens, J. S.* Phys. Rev. 7 (1898) 19-26.
- Valenta, E.* Verh. Ges. deutsch. Naturf. u. Aerzte (1895) 78-79.
- Vogel, H. W.* Verh. d. physikal. Ges. Berlin 16 (1897) 176-178.
- Wadsworth, F. L. O.* Phys. Rev. 4 (1897) 480-497; Beibl. (1898) 623.
- Walker, J.* Phil. Mag. (5) 46 (1898) 472-478, 553-557; Beibl. (1899) 183.



Wiedemann, E., und G. C. Schmidt. Ann. Phys. n. F. 60 (1896) 510-518.

Wilberforce, L. R. Cambridge Trans. 14 II (1887) 170-187.

## INVERSION.

Bélopolsky, A. Mem. Spettro Ital. 25 (1896) 23-26

Chen, E. Ztsch. f. physikal. Chem. 28 (1898) 145-153.

Eder, J. M., und E. Valenta. Denk. d. Wiener. Akad. (1898) 11 pp

Kipping, F. S., and W. J. Pope. J. Chem. Soc. 71 (1897) 956-962.

Pellat. Bull. Soc. philomath. Paris 11 (1886-1887) 155-160, Beibl. (1887) 705.

Svejcar, V. Boehm math. phys. Ztsch. 21 (1892) 238

Vorlt, W. Ann. Phys. n. F. 68 (1899) 604-606

Wullner, A. Ann. Phys. n. F. 34 (1888) 647.

## INVISIBLE SPECTRUM.

Langley, S. P. Amer. J. Sci. (3) 36 (1886) 397-410; Phil. Mag. (5) 26 (1888) 505-520; Beibl. (1889) 314-338.

Niewenglowski, G. H. Paris. Desforges, 1896, 23 pp.

Signac, G. J. de phys. (3) 5 (1896) 193-202

Schumann, V. Photogr. Rundsch. (1892) 33 pp

Smyth, C. P. Rept. Brit. Assoc. (1890) 750-751; Beibl. (1892) 279

Stefanini, A. Nuov. Cim. (4) 4 (1896) 18-24

Stoney, G. J. Phil. Mag. (5) 34 (1892) 415-428.

Zenger, Ch. C.-R. 109 (1889) 434-436; Beibl. (1890) 37

## IODINE.

Dewar, J. Cambridge Proc. 10 (1899) 44-47

Gramont, A. de. Ann. chim. phys. (7) 10 (1897) 213-234.

Hasselberg, B. Mem. Acad. St. Petersburg. (7) 36 (1889) 50 pp.; Jahresb. (1889) 318.

Henry, J. Cambridge Proc. 9 (1897) 319-322; Beibl. (1898) 169

Herzig, J. Sitzb. Wiener Akad. 107 IIb (1898) 111-115

Kastle, J. H. Amer. Chem. J. 21 (1899) 398-413; Beibl. (1899) 782

Konen, H. Diss. Bonn, 1897. 72 pp. Ann. Phys. n. F. 65 (1898) 257-286.

Kruss, G., und Thiele, E. Ztsch. f. anorg. Chem. 7 (1894) 52-81; Beibl. (1894) 1047

Kuester, F. W. Ztsch. f. physikal. Chem. 16 (1895) 156-171.

Lea, M. C. Amer. J. Sci. (3) 38 (1887) 349-364; Beibl. (1888) 50.

Luudeking, C. Beibl. (1890) 511, Chem. News 61 (1890) 1-2

*Nordenskiöld, A. E.* Oefvers. Stockholm Akad. Forh. 44 (1887) 471-478.

*Rideal, S.* Rept. Brit. Assoc. (1894) 611.

*Rigollot, H.* C.-R. 112 (1891) 38-40; Beibl. (1891) 280.

*Stock, A.* Sitzb. phys. med. Erlangen 13. Feb., 1893; Beibl. (1893) 1059.

*Thiele, F.* Ztsch. f. phys. Chem. 16 (1895) 147-156; Beibl. (1895) 426.

*Tissandier, G.* La Nature 18 (1890) 219-220.

*Wood, R. W.* Phil. Mag. (5) 41 (1896) 423-431; Beibl. (1896) 776.

#### IRIDIUM.

*Poland, L. N. P.* Dingler's J. 278 (1890) 46.

#### IRON.

*Andrews, L.* Proc. Iowa Acad. Sci. 1, Part IV; Chem. News 70 (1897) 165-166.

*Cardani, P.* Atti Accad. Roma 4 (1895) 242-250.

*Cohen, E.* Sitzb. Berliner Akad. (1898) 607-608.

*Hartley, W. N.* Proc. Roy. Soc. 56 (1894) 193-199.

—— — —. Rept. Brit. Assoc. (1894) 610; Beibl. (1896) 26.

—— — —. Proc. Roy. Soc. 59 (1896) 98-101; Beibl. (1896) 367.

—— — — and *H. Ramage.* Proc. Roy. Soc. 60 (1897) 393-407.

*Humphreys, W. J.* Astrophys. J. 6 (1897) 169-232.

*Isambert, F.* C.-R. 102 (1886) 423-425; Jahresb. 410.

*Kruss, G., und H. Mohraht.* Ber. chem. Ges. 22 (1889) 2054-2060.

*Lemoine, G.* Ann. chim. phys. (7) 6 (1895) 433-540.

*Living, G. D., and J. Dewar.* Proc. Roy. Soc. 43 (1887-1888) 430. Abs.

*Lockyer, J. N.* Proc. Roy. Soc. 54 (1893) 359-361.

—— — —. Proc. Roy. Soc. 54 (1894) 139-141; Beibl. (1894) 767.

—— — —. Phil. Trans. 185 (1895) 983-1029.

—— — —. Nature 51 (1895) 448-449; Beibl. (1896) 33.

—— — —. Proc. Roy. Soc. 60 (1897) 475-477; Astron. Nachr. 143 (1897) 59-61.

*Loewenherz, L.* Ztsch. f. Instrum. 9 (1889) 316-337.

*Lundström, C. J.* Proc. Roy. Soc. 59 (1896) 76-98; Beibl. (1896) 367.

*Magnanini.* Rend. Accad. Roma 7 (1891) 104-112.

*Moissan, H. et Ch. Moureaux.* C.-R. 122 (1896) 1240-1243.

*Newall, H. F.* Phil. Mag. (5) 24 (1887) 435-439.

*Osmond,* C.-R. 103 (1886) 743; Jahresb. (1886) 409.

- Parry, J.* Nature 45 (1892) 253-255; Beibl. (1893) 748.  
 ——. Engineering 60 (1895) 585.  
*Porter, T. C.* Nature 45 (1892) 558-559; Beibl. (1892) 666.  
*Ramsay, W.* Nature 52 (1895) 224-225; C.-R. 120 (1895) 1049-1050.  
*Russell, W. J., and W. J. Orsman.* Chem. News 59 (1889) 93 94; Beibl. (1890) 280.  
*Staats, G.* Ber. chem. Ges. 21 (1888) 2199.  
*Trowbridge, J.* Amer. J. Sci. (3) 48 (1894) 307-311.  
*Vogel, H. C.* Sitzb. Berliner Akad. 28 (1891) 533-539; Beibl. (1892) 155.  
*Zeeman, P.* Astrophys. J. 9 (1899) 47-49; Amsterdam. Akad. Verh. June 25, 1898.  
*Zsigmondy, R.* Ann. Phys. n. F. 49 (1893) 531

## IRREVERSIBLE SPECTRA See REVERSAL.

## K LINES.

- Hale, G. E.* C.-R. 116 (1893) 170-173.  
 ——. Astrophys. J. 6 (1897) 157.  
*Maury, A. C.* Astrophys. J. 8 (1898) 173-175.

## KRYPTON.

- Berthelot, D.* C.-R. 126 (1898) 1613.  
*Crookes, W.* Proc. Roy. Soc. 63 (1898) 408-411.  
*Moissan, H., et H. Deslandres.* C.-R. 126 (1898) 1689-1691.  
*Ramsay, W.* Nature 59 (1898) 53; C.-R. 126 (1898) 1610-1613, 1702-1763.  
 ——. and *M. W. Travers.* Proc. Roy. Soc. June 3, 1898; Astrophys. J. 8 (1898) 120-122.

## LANTHANUM.

- Crookes, W.* Chem. News 56 (1887) 62, 81-82; Beibl. (1888) 195  
*Humphreys, W. J.* Astrophys. J. 6 (1897) 169-232.  
*Lohse, O.* Denkschr. Berliner Akad. (1897) 29 pp.; Astrophys. J. 6 (1897) 95-118  
*Rowland, H. A., and C. Harrison.* Astrophys. J. 7 (1898) 373-389.

## LEAD.

- Humphreys, W. J.* Astrophys. J. 6 (1897) 169-232.  
*Kayser, H., und C. Runge.* Denkschr. d. Berliner Akad. (1893) 20 pp

## LENARD'S RAYS

- Des Courdes, Th.* Ann. Phys. n. F. 62 (1897) 134-144.

## LIGHTNING. See also under ELECTRIC.

*Fowler, A.* Nature 46 (1892) 268; Beibl. (1893) 125.

*Glaserapp, S. von.* Photogr. Mittheil. 29 (1892) 111-113.

## LIQUIDS.

*Aubel, E. van.* Arch. de Genève (5) 3 (1897) 201-203.

*Battelli, A., e M. Pandolfi.* Nuov. Cim. 9 (1899) 321-327; Beibl. (1899) 633.

*Brace, D. B.* Astrophys. J. 5 (1897) 214.

*Bruehl, J. W.* Ber. chem. Ges. 2746.

*Dewar, J.* J. de phys. (3) 7 (1898) 389-393.

*Fahrig, E.* Chem. Centralbl. (4) 2 (1890) 329; Chem. News 62 (1890) 39.

*Fievez, Ch., et E. van Aubel.* Bull. Acad. Belg. (3) 17 (1889) 102-104; Jahresb. (1889) 319.

*Friedel, Ch.* Ann. Phys. n. F. 55 (1895) 453-478.

*Hallwachs, W.* Ann. Phys. n. F. 50 (1893) 577.

*Hartley, W. N.* Nature 44 (1891) 273.

*Hibbert, W.* Phil. Mag. (5) 39 (1895) 321-345; Beibl. (1895) 193.

*Lachowicz, Br.* Ber. chem. Ges. 20 (1887) 735-743; Beibl. (1887) 708.

*Lagrange, E., et P. Hoho.* Bull. Acad. Belg. (3) 22 (1891) 205-225; 23 (1892) 502-506.

*Littlewood, T. H.* Phil. Mag. (5) 37 (1894) 467-470.

*Liveing, G. D., and Dewar, J.* Phil. Mag. (5) 34 (1892) 205-209; Beibl. (1893) 121.

——, ———. Phil. Mag. (5) 37 (1894) 235-249; Beibl. (1895) 60.

——, ———. Phil. Mag. (5) 39 (1895) 268-272; Beibl. (1896) 31, 193.

*Madan, H. G.* J. f. Mikroskop. (1898) 273-281; Beibl. (1898) 769.

*Marey.* Soc. franc. de phys. (1893) 5.

*Paur, J.* Ann. Phys. n. F. 61 (1897) 363-379.

*Pulfrich, C.* Ztsch. physikal. Chem. 4 (1889) 561; Jahresb. (1889) 312.

*Rubens, H., und E. Ashkinass.* Ann. Phys. n. F. 64 (1898) 602-605.

*Ruoss, H.* Ann. Phys. n. F. 48 (1893) 531.

*Staigmueller, H.* Beibl. (1897) 28.

*Stscheglaiew, J.* Ann. Phys. n. F. 64 (1898) 325-332.

*Winkler, L. W.* Ztsch. physikal. Chem. 9 (1892) 171-176.

*Zecchini, F.* Gazz. chim. Ital. 27 (1897) 358-384; Beibl. (1897) 732.

*Zsigmondy, R.* Ann. Phys. n. F. 57 (1895) 639-645.

## LITHIUM.

- Bell, L.* Amer. J. Sci. (3) 7 (1885) 35; Jahresb. (1885) 317, 318.  
*Deslandres, H.* C.-R. 121 (1895) 886-887.  
*Eder, J. M., und E. Valenta.* Denkschr. d. Wiener Akad. 60 (1893) 467-476; (1898) 11 pp.; Beibl. (1894) 909, (1899) 250.  
*Exner, F., und Haschek, E.* Sitzb. Wiener Akad. 106 (1897) 1127-1152. Beibl. (1898) 400.  
*Gramont, A. de.* C.-R. 122 (1896) 1411-1413, Beibl. (1896) 693.  
*Humphreys, W. J.* Astrophys. J. 6 (1897) 169-232.

## LONGITUDINAL SPECTRA.

- Mach, E. and L.* Sitzb. Wiener Akad. 98 (1889) 1327-1332.  
*Nichols, E. L.* Sitzb. Berliner Akad. (1896) 1183-1196; Ann. Phys. n F. 60 (1897) 401-417.  
*Poincaré, H.* C.-R. 121 (1895) 792-794.  
*Lutium.* Chem. News 74 (1896) 259

## MAGNESIUM.

- Crew, H., and O. H. Basquin.* Astrophys. J. 2 (1895) 100-102; Beibl. (1896) 30.  
*Gruenwald, A.* Monatsh. f. Chem. 8 (1887) 650-712, Beibl. (1888) 661-662.  
*Humphreys, W. J.* Astrophys. J. 6 (1897) 169-232.  
*Julius, V. A.* Natuurk. Verh. d. Akad. Amsterdam 26 (1888) 11 pp.; Beibl. (1889) 496-499.  
*Kesler, J. E.* Astron. Nachr. 136 (1894) 77-80; Beibl. (1895) 60.  
*Living, G. D., and Dewar, J.* Proc. Roy. Soc. 44 (1888) 241-252; Beibl. (1888) 381.  
*Lockyer, J. N.* Proc. Roy. Soc. 46 (1889) 35-40; Beibl. (1889) 812.  
*Rogers, F. J.* Amer. J. Sci. (3) 43 (1892) 301-314; Beibl. (1892) 606.  
*Troost, L., et L. Ouward.* C.-R. 121 (1895) 394-396.  
*Vogel, H. W.* Photogr. Mittheil. 31 (1895) 367-369; Beibl. (1895) 422.  
 ——. Eder's Jahrb. 10 (1896) 230-236; Beibl. (1896) 980.  
*Zeeman, P.* Versl. Akad. Amsterdam (1894 1895) 231; Beibl. (1895) 570.

## MANGANESE.

- Boisbaudran, F. Lecoq de.* C.-R. 103 (1886) 468-471, 1064; 104 (1887) 1680; 105 (1887) 45-48, 206, 784, 1228; Beibl. (1887) 584.  
*Hartley, W. N.* Proc. Roy. Soc. 56 (1894) 192-193.  
*Hasselberg, B.* K. Svensk. Vet. Akad. Handl. 30 (1897) 20 pp.  
*Humphreys, W. J.* Astrophys. J. 6 (1897) 169-232.

- Klatt, V., und Lenard, Ph.* Ann. Phys. n. F. 38 (1889) 90-107.  
*Mourelot, J. R.* C.-R. 128 (1899) 1239-1241; Beibl. (1899) 485.  
*Rousseau, G.* C.-R. 102 (1886) 425, 616; Jahresb. (1886) 413-417.  
 ——. C.-R. 103 (1886) 261-264.

## MAPS OF SPECTRA.

- Crew, H., and R. Tatnall.* Phil. Mag. (5) 38 (1894) 379-386.  
 ——. Astrophys. J. 2 (1895) 318-320; Beibl. (1896) 530.  
*Huggins, Sir W., and Very, F. W.* Astrophys. J. 6 (1897) 55-56.  
*Keeler, J. E.* Astrophys. J. 6 (1897) 144.  
*Rowland, H. A.* Chem. News 59 (1889) 124-125; Beibl. (1889) 682.  
*Sidgreaves, Maunder, McClean, and Herschel.* Astrophys. J. 5 (1897) 216.  
*Rowland, H. A.* Photographic Map of the Normal Solar Spectrum. Privately printed.

## MAXIMA OF SPECTRA.

- Aymonnet, F.* C.-R. 114 (1892) 582-685; 117 (1893) 304-306, 402-405; 123 (1896) 645-648; Beibl. (1893) 336, 1057, 1058.

## MERCURY.

- Dufet, H.* Bull. Soc. min. France 21 (1898) 89-94; Beibl. (1899) 32.  
*Eder, J. M., und Valenta, A.* Denkschr. d. Wiener Akad. 61 (1894) 30 pp.  
*Fabry, Ch., et Perot, A.* C.-R. 126 (1898) 1706-1708.  
*Humphreys, W. J.* Astrophys. J. 6 (1897) 169-232.  
*Jones, A. C.* Ann. Phys. n. F. 62 (1897) 30-53; Astrophys. J. (1898) 150.  
*Living, G. D.* Proc. Cambridge Phil. Soc. 10 (1899) 38-40; Beibl. (1899) 781.  
*Ostwald, W.* Ztsch. f. physikal. Chem. 18 (1895) 159-161.  
*Rayleigh, Lord.* Phil. Mag. (5) 34 (1892) 309-320; Beibl. (1892) 833.

## METALS.

- Ashkinass, E.* Verh. d. physikal. Ges. Berlin 17 (1898) 101-105.  
*Becquerel, H.* C.-R. 112 (1891) 557-563.  
*Berget, A.* C.-R. 114 (1892) 1350-1352.  
*Berthelot.* Ann. chim. phys. (7) 16 (1899) 320-324.  
*Bloch, S.* Ann. chim. phys. (7) 11 (1897) 74-115.  
*Carrara, G.* Rend. Accad. Roma (5) 17 (1893) 353-358; Beibl. (1893) 742.  
*Chabaud, V.* C.-R. 122 (1896) 237-238.

- Cochin, D.* C.-R. 116 (1893) 1055-1057; Beibl. (1893) 652
- Cornu, A.* C.-R. 108 (1889) 1211-1217; 126 (1898) 181-186, 300
- Crew, H.* Beibl. (1896) 530; *Astrophys. J.* 2 (1895) 318-320
- Deslandres, H.* *Ann. chim. phys.* (6) 15 (1888) 5-86, Beibl. (1889) 809
- Drude, P.* *Ann. Phys. n. F.* 39 (1890) 481; 47 (1893) 595; 51 (1894) 77.
- Dubois, H. E. J., und Rubens, H.* *Sitzb. Berliner Akad.* (1890) 955-968.
- Dudley, W. L.* *Nature* 47 (1892) 175.
- . *Chem. News* 66 (1892) 163-165; Beibl. (1893) 123, 206.
- . *Amer. Chem. J.* 14 (1893) 185-190.
- Eder, J. M.* *Denkschr. d. Wiener Akad.* 60 (1893) 24 pp.; Beibl. (1894) 910-912.
- Emden, R.* *Ann. Phys. n. F.* 36 (1889) 214-236.
- Ghira, A.* *Rend. Accad. Roma* 3 (1894) 301-303.
- Giesel, F.* *Ber. chem. Ges.* 30 (1897) 156-158; Beibl. (1897) 337
- Gladstone, J. H.* *Rept. Brit. Assoc.* (1892) 679.
- Goldstein, E.* *Verh. physikal. Ges. Berlin* (1886) 38-41; Beibl. (1890) 616.
- Gouy, C.-R.* 108 (1889) 1236-1238; Beibl. (1889) 677.
- Gramont, A. de.* C.-R. 118 (1894) 591-594, 746-749, Beibl. (1894) 838.
- . C.-R. 119 (1894) 68-70; Beibl. (1894) 912.
- . C.-R. 121 (1895) 121-123, 122 (1896) 1326-1328, 1411-1413, 1534-1536; 124 (1897) 192-194; 125 (1897) 172-175, 238-240; Beibl. (1896) 30, 693, 775; (1897) 973.
- . C.-R. 126 (1898) 1155-1157, 1234, 1513-1515
- Hartley, W. N.* *Proc. Roy. Soc.* 46 (1889) 88-90.
- . *Chem. News.* 66 (1892) 311-314; Beibl. (1893) 925.
- and *H. Ramage.* *Chem. News* 75 (1897) 151; 76 (1897) 231; 77 (1898) 121-122.
- Hasselberg, B.* Beibl. (1894) 837; (1896) 304, 692; (1898) 401; (1899) 634; *Astrophys. J.* (1896) 116-134, 212-233; 5 (1897) 38-39.
- Hlawatsch, C.* Beibl. (1897) 511.
- Hurmuzescu, D.* *Éclair. élect.* 15 (1889) 166-168.
- Hutchins, C. C.* *Amer. J. Sci.* (3) 37 (1889) 474-476; Beibl. (1889) 883.
- Jewell, L. E.* *Astrophys. J.* 3 (1896) 89-113.
- Jones, A. E.* *Diss., Erlangen; Ann. Phys. n. F.* 62 (1897) 30-53.
- Kath, H.* *Ann. Phys. n. F.* 62 (1897) 328-352.



- Kaufmann, W.* Verh. d. physikal. Ges. 16 (1897) 116-118.
- Kundt, A.* Ann. Phys. n. F. 27 (1886) 59. See E. van Aubel, Bull. Acad. Belg. 11 (1886) 408.
- . Sitzb. Berliner Akad. (1888) 469; Phil. Mag. (5) 26 (1888) 1.
- . Sitzb. Berliner Akad. (1888) 1387-1394; Jahresb. (1888) 425; (1889) 322.
- Kurnakow, N. S.* Ztsch. f. anorg. Chem. 17 (1898) 207-235; Beibl. 22 (1898) 775.
- Le Bel, J. A.* Ber. chem. Ges. 28 (1895) 1923-1925.
- Lewis, E. P., and E. S. Ferry.* Johns Hopkins Univ. Cir. No. 12; Beibl. (1895) 242.
- Living, G. D., and Dewar, J.* Proc. Roy. Soc. 52 (1892) 117-123; Beibl. (1893) 1056.
- Lockyer, J. N.* C.-R. 120 (1895) 1103-1105; Beibl. (1895) 566.
- . Proc. Roy. Soc. 60 (1896) 133-140.
- Lohse, O.* Sitzb. Berliner Akad. 12 (1897) 179-197; Astrophys. J. 6 (1897) 95-118.
- Lorentz, H. A.* Ann. Phys. n. F. 46 (1892) 244.
- Lummer und Kurlbaum.* Ztsch. f. Instrum. 18 (1898) 144-145; Beibl. (1898) 664.
- Macaluso, D., et Corbino, O. M.* C.-R. 127 (1898) 548-551, 951-953.
- , ———. Rend. Accad. Roma 8 (1899) 38-41; Nuov. Cim. 9 (1899) 381-384.
- Morley, E. W., and W. A. Rogers.* Phys. Rev. 4 (1896) 1-23, 106-127.
- Newth, G. S.* Nature 47 (1892) 55; Beibl. (1893) 335.
- Ojffret, A.* Bull. Soc. min. de France 13 (1890) 405-688; Beibl. (1891) 565.
- Parry, J.* London: Pontypool, 1885; Beibl. (1890) 853.
- Pflueger, A.* Ann. Phys. n. F. 58 (1896) 493-499; Astrophys. J. 5 (1897) 68.
- . Ann. Phys. n. F. 65 (1898) 214-224; Astrophys. J. 9 (1899) 187.
- Provenzali, F. S.* Atti Accad. Lincei 43 (1890) 131-138; Beibl. (1891) 281.
- Puljrich, C.* Ann. Phys. n. F. 59 (1896) 671.
- Ramsay, W., and Travers, M. W.* Proc. Roy. Soc. 60 (1897) 442-448.
- Rathenau, W.* Diss., Berlin (1889); Beibl. (1894) 189.
- Rayleigh, Lord.* Edinb. Trans. 33 (1885-1886) 157-170; Beibl. (1888) 198-200.
- Reports on the Spark Spectra of the Metals. Repts. Brit. Assoc.
- Righi, A.* Rend. Accad. Roma 5 (1889) 860-862.

- Roberts-Austen, W. C.* Nature 45 (1892) 534-541.  
 ———. Roy. Inst. Gr. Brit. March 15, 1895, 24 pp.  
*Roiti, A.* Rend. Accad. Roma 7 I (1898) 87-91; Nuov. Cim. 7 (1898) 204-206.  
*Rood, O. V.* Amer. J. Sci. (4) 2 (1896) 173-180.  
*Rowland, H. A., and Tatnall, R. R.* Astrophys. J. (1896) 286-292.  
*Rubens, H.* Ann. Phys. n. F. 37 (1889) 249; Jahresb. (1889) 322.  
*Sabatier, P.* C.-R. 126 (1898) 86-87.  
*Schottlaender, P.* Ber. chem. Ges. 25 (1892) 378-395, 569-599.  
*Schumann, V.* Chem. News 62 (1890) 299; Beibl. (1891) 205.  
*Shea, D.* Ann. Phys. n. F. 47 (1892) 177.  
*Smithells, A.* Chem. News 66 (1892) 139-140.  
*Snow, B. W.* Phys. Rev. 3 (1893) 221-223; Beibl. (1894) 912.  
*Traube, J.* Ber. chem. Ges. 30 (1897) 38-43.  
*Travers, M. W.* Chem. News 78 (1898) 317-318.  
*Troubridge, J., and W. C. Sabine.* Phil. Mag. (5) 26 (1888) 316; 342-353; Beibl. (1889) 18, 382.  
*Viola.* Atti Accad. Lincei 5 (1896) 212-216.  
*Vogel, O.* Ztsch. f. anorg. Chem. 5 (1893) 42-62; Beibl. (1894) 84.  
*Watt, A.* Dingler's Jour. 267 (1888) 20-24.  
*Weinschenck, E.* Ztsch. f. anorg. Chem. 12 (1896) 375-393; Beibl. (1896) 777; (1897) 515.  
*Wernicke, W.* Ann. Phys. n. F. 30 (1887) 469-473; 51 (1894) 448; 52 (1894) 515.  
*Wiedemann, E., und G. C. Schmidt.* Sitzb. phys. med. Erlangen (1895); Beibl. (1896) 693.  
*Wien, W.* Ann. Phys. n. F. 35 (1888) 48-62; Jahresb. (1888) 444.  
*Wiener, O.* Ann. Phys. n. F. 31 (1887) 629-673.  
*Winkelmann, A.* Ann. Phys. n. F. 32 (1887) 439-442.  
*Zeeman, P.* Phil. Mag. (5) 45 (1898) 197-201.  
*Zimanyi, K.* Ber. aus Ungarn 11 (1893) 189-232.

## METARGON.

- Berthelot, C.-R.* 126 (1898) 1613. See Ramsay and Travers, same vol. 1610.  
*Crookes, W.* Chem. News 78 (1898) 25-26.  
*Dewar, J.* Nature 58 (1898) 319; Beibl. (1899) 395.  
*Ramsay, W., and Travers, M. W.* Proc. Roy. Soc. 63 (1898) 405-408; Beibl. (1898) 513.  
 ———, ———, and E. C. Baily. Nature 58 (1898) 245-246; Beibl. (1898) 772.

- Ramsay, W., and Travers, M. W. (*Cont'd.*) Proc. Roy. Soc. June 3, 1898; *Astrophys. J.* 8 (1898) 120-122.  
 Rydberg, J. R. *Nature* 58 (1898) 319; *Beibl.* (1899) 395.  
 Schuster, A. *Nature* 58 (1898) 199, 269; *Beibl.* (1898) 513, 772.

## METEOROLOGICAL.

- Amsler, J. S. *Ztsch. phys. chem. Unterr.* 8 (1895) 6, 319-320.  
 Benoit, R. *Soc. franç. de phys.* (1897) 95-106.  
 Bock, A. *Ann. Phys. n. F.* 68 (1898) 674-687.  
 Brillouin, M. *C.-R.* 123 (1896) 484-486.  
 Chwolson, O. *Repert. d. Phys.* 26 (1890) 364-377.  
 Colley, Michkine et Kazine. *Ann. chim. phys.* (6) 25 (1892) 265-286.  
 Cook, C. S. *Amer. J. Sci.* (3) 39 (1890) 258-268.  
 Cornu, A. *Nature* 53 (1896) 588-592; *Beibl.* (1896) 698.  
 Cranz, C. *Meteorol. Ztschr.* (1890) 399-400; *Beibl.* (1891) 356.  
 Crova, A. *C.-R.* 109 (1889) 493-496; *Beibl.* (1890) 37; (1891) 36.  
 ——. *C.-R.* 112 (1891) 1176-1179, 1246-1247; *Beibl.* (1891) 768.  
 ——. *Ann. chim. phys.* (6) 25 (1892) 286-288; *Beibl.* (1892) 609.  
 —— et Houdaille. *C.-R.* 108 (1889) 35-39; *Beibl.* (1889) 219.  
 Czermak, P. *Meteorol. Ztschr.* 12 (1895) 308-312; *Beibl.* (1896) 125.  
 Ekama, H. *J. de phys.* (2) 9 (1890) 97-99; *Beibl.* (1890) 625.  
 ——. *Beibl.* (1898) 155.  
 Elster, J., und H. Geitel. *Wiener Anzeiger* (1892) 43.  
 Exner, K. *Meteorolog. Ztschr.* 13 (1896) 401-404; 14 (1897) 156.  
 Frost, E. B. *Astrophys. J.* 6 (1897) 279; 6 (1897) 57.  
 Hartley, W. N. *Nature* 38 (1889) 474-477; *Beibl.* (1889) 509.  
 Hesehus, N. A. *J. de phys.* (3) 2 (1893) 505-507.  
 Janssen, J. *C.-R.* 107 (1888) 672-677; *Beibl.* (1889) 383.  
 Jesse, O. *Nature* 43 (1890) 59-61; *Beibl.* (1891) 355.  
 ——. *Astron. Nachr.* 140 (1896) 161-167; *Beibl.* (1896) 697.  
 Jewell, L. E. *Astrophys. J.* 4 (1896) 279-281, 324-342.  
 Klein, H. J. *Sirius* 24 (1896) 265-268.  
 Knott, G. G., and R. A. Lundie. *Proc. Roy. Soc. Edinb.* (1898) 350-352; *Beibl.* (1899) 424.  
 Kurz, A. *Repert. d. Phys.* 27 (1891) 311-314.  
 ——. *Ztsch. f. Math. u. Phys.* 37 (1892) 318-320.  
 Larmor, J. *Cambridge Proc.* 6 (1889) 281-286.  
 Lépinay, J. Macé de. *J. de phys.* 7 (1898) 209-216; *Beibl.* (1899) 30.  
 Ley, W. Cl. *Nature* 46 (1892) 294.  
 Lommel, E. von *Abhandl. d. Bayer. Akad.* 19 (1897) 60 pp.  
 Lummer, O. *Ann. Phys. n. F.* 62 (1897) 14-19.

- Mach, E., und Salcher, P.* Sitzb. Wiener Akad. 98 (1889) 1303-1309.
- McConnel, J.* Phil. Mag. (5) 27 (1889) 272-279; 29 (1890) 167-173; Beibl. (1890) 520.
- Phil. Mag. (5) 29 (1890) 453-461; Beibl. (1890) 991-992.
- Mascari, A.* Mem. Soc. Spett. Ital. 27 (1898) 81-90.
- Mascart, C.-R.* 115 (1892) 429-435, 453-455.
- Maurer, J.* Meteorol. Ztschr. 16 (1899) 257-260; Beibl. (1899) 637.
- Michelson, A. A.* Soc. franç. de phys. (1893) 3-5.
- Monck, W. H. S.* Pub. A. S. P. 9 (1896) 33-36.
- Paulsen, A.* Meteorol. Ztschr. 8 (1895) 11-14.
- Pellat, Bull. Soc. philom. Paris* 12 (1887-1888) 22-23; Beibl. (1888) 662.
- Pernter, J. M.* Sitzb. Wiener Akad. (1888) 1299-1306; (1889) 1562-1586.
- Meteorol. Ztschr. 6 (1889) 130-136, 401-409; 7 (1890) 41-50, Beibl. (1889) 685; (1890) 122, 806.
- Nature 56 (1897) 80; Sitzb. Wiener Akad. 106 IIa (1897) 135-235.
- Wiener Anzeiger (1898) 8 pp.; Beibl. (1899) 640.
- Piltchikoff, N.* C.-R. 115 (1892) 555-558; Beibl. (1893) 337.
- Pulfrich, C.* Ann. phys. n. F. 33 (1888) 194-209, 209-212.
- Renou, C.-R.* 110 (1890) 851-853; Beibl. (1890) 625.
- Riccó, A.* Mem. Spett. Ital. 25 (1896) 8 pp.; Beibl. (1896) 978.
- Rideal, S.* Rept. Brit. Assoc. (1894) 611.
- Schirps, K.* Naturwiss. Rundsch. 12 (1897) 654; Beibl. (1898) 154.
- Sidgreaves, W.* Stonyhurst Coll. Observ. (1894) 84 pp; (1895) 80 pp.
- Trabert, W.* Meteorol. Ztschr. 9 (1892) 41-46; Beibl. (1892) 425.
- Tumlirz, O., und A. Krug.* Sitzb. Wiener Akad. 97 II (1889) 1529-1559.
- Vogel, H. W.* Verh. d. physikal. Ges. Berlin 10 (1891) 35-46; Beibl. (1891) 560.
- Photogr. Mittheil. 28 (1891) 73; 29 (1892) 73-75, 138-141, 156-159, 172-175; Beibl. (1892) 740.
- Wyss, G. H.* Beibl. (1889) 508.

## METHEMOGLOBIN.

- Bertin, H.* C.-R. 106 (1888) 1243-1245; Beibl. (1888) 662.
- Dittrich, P.* Ztsch. f. analyt. Chem. 31 (1892) 593; Beibl. (1893) 123.

## MOLYBDENUM.

- Humphreys, W. J.* Astrophys. J. 6 (1897) 169-232

## MOSANDRUM.

*Boisbaudran, F. Lecoq de.* C.-R. 102 (1886) 647.—*Crookes*, Proc. Roy. Soc. 40 (1886) 236.

## MULTIPLE SPECTRA.

*Trowbridge and Richards.* Amer. J. Sci. (4) 3 (1897) 117-120.

## NEODYMIUM.

*Boudouard, O.* C.-R. 126 (1898) 900-901.

*Demarçay, E.* C.-R. 126 (1898) 1039-1041.

*Humphreys, W. J.* Astrophys. J. 6 (1897) 169-232.

## NEON.

*Editors of Science.* Sci. n. S. 8 (1898) 18-19.

## NICKEL.

*Hassclberg, B.* Beibl. (1896) 692; Astrophys. J. 4 (1896) 288-304, 343-366, plates.

*Humphreys, W. J.* Astrophys. J. 6 (1897) 169-232.

*Liveing, G. D., and J. Dewar.* Phil. Trans. 179 I (1888) 231-256; Beibl. (1889) 217.

*Moissan, H., et Ch. Moureau.* C.-R. 122 (1896) 1240-1243.

*Ramsay, W., and M. W. Travers.* Chem. News 78 (1898) 154-155.

—, —. Proc. Roy. Soc. June 3, 1898; Astrophys. J. 8 (1898) 120-122.

*Sabatier, P., et J. B. Senderens.* C.-R. 124 (1897) 616-618.

## NIOBIUM.

*Humphreys, W. J.* Astrophys. J. 6 (1897) 169-232.

## NITROGEN.

*Armstrong, H. E.* J. Chem. Soc. (1892); Chem. News 65 (1892) 284-285.

*Baccei, P.* Mem. Spettr. Ital. 28 (1899) 97-102.

*Baly, E. C. C.* Chem. News 71 (1895) 169-170.

*Brühl, J. W.* Ber. chem. Ges. 26 (1893) 806-810.

— — —. Ztsch. f. physikal. Chem. 15 (1894) 19-226, 226-242; 16 (1895) 193-241, 497-524; 24 (1897) 373-409; 25 (1898) 577-650; 26 (1898) 47-76.

*Costa, T.* Rend. Accad. Roma 7 (1891) 308-313; Beibl. (1892) 424.

*Deslandres, H.* C.-R. 121 (1895) 886-887.

*Eder, J. M.* Wiener Anzieger (1892) 44-47; Beibl. (1893) 204.

— — —. Denkschr. d. Wiener Akad. 60 (1893) 24 pp.; Beibl. (1894) 910-912.

- Hasselberg, B.* Mem. Spettr. Ital. 15 (1886) 1-3, Beibl. 1888) 349.  
*Kock, E.* Ann. Phys. n. F. 32 (1887) 167.  
*Konowalow, M. J.* Russ. phys. chem. Ges. (7) 27 (1897) 412-421; Beibl. (1897) 966.  
*Kostanecki, St. von.* Ber. chem. Ges. 24 (1891) 150-156.  
*Leduc, A.* C.-R. 123 (1896) 805-807.  
*Limb, C.* C.-R. 121 (1895) 887-888.  
*Liveing, G. D., and J. Dewar.* Phil. Mag. (5) 34 (1892) 205-209; Beibl. (1893) 121.  
 ———, ———. Phil. Mag. (5) 36 (1893) 328-331; Beibl. (1894) 334.  
 ———, ———. Phil. Mag. (5) 37 (1894) 235-249; Beibl. (1895) 60.  
*Loewenherz, R.* Ber. chem. Ges. 23 (1890) 2180.  
*Magnanini, G.* Rend. Accad. Roma (4) 5a (1889) 908-912; Jahresb. (1889) 320.  
*Moureaux, C.* C.-R. 121 (1895) 819-820.  
*Nasini e Costa.* Rend. Accad. Roma 7 (1891) 623-631; Beibl. (1892) 146-148.  
 ——— e *Carrara.* Gazz. chim. Ital. 24 (1894) 256-291; Beibl. (1894) 834.  
*Neovius, O.* Svensk. Vet. Akad. Handl. 17 (1891) 69 pp.; Beibl. (1893) 563.  
*Ramsay, W., and M. W. Travers.* Proc. Roy. Soc. 62 (1898) 225-232; Beibl. (1898) 217.  
 ———. Proc. Roy. Soc. 64 (1899) 181-183.  
*Rayleigh, Lord.* Nature 46 (1892) 512-513.  
 ———. Proc. Roy. Soc. 54 (1894) 340-344; Chem. News 69 (1894) 231-232.  
*Seguy, G.* C.-R. 121 (1895) 198-199.  
*Sundell, A. F.* Phil. Mag. (5) 24 (1887) 98.  
*Tissandier, G.* La Nature 18 (1890) 219-220.  
*Tropesonjanz, Ch.* Ber. chem. Ges. 26 (1893) 1428-1433.  
*Traube, J.* Ber. chem. Ges. 30 (1897) 43-47.  
*Tutton, A. E.* Nature 51 (1895) 258.

## OILS.

- Donath, Br.* Ann. Phys. n. F. 58 (1896) 609-661.  
*Jean, F.* Beibl. (1891) 33.

## OPAL.

- Kleeefeld, N.* Jahrb. [f. Min., Geol. u. Paleont. (1895) 146; Beibl. (1895) 786.

- Kleefeld*. (Cont'd). Ztsch. f. Kryst. u. Min. 28 (1897) 619.  
*Wichmann, A.* N. Jahrb. f. Min., Geol. u. Paleont. 2 (1895) 253-254;  
 Beibl. (1897) 978.

## ORGANIC.

- Barbier, Ph., et L. Roux.* C.-R. 112 (1891) 582-584; Beibl. (1891) 556.  
*Blake, J.* C.-R. 104 (1887) 1544-1556.  
 ——. Mem. Soc. de Biologie, Paris, (1890) 4 pp.  
*Coupin, H.* La Nature 21 (1893) 99-100.  
*Hartley, W. N.* J. Chem. Soc. 59-60 (1891) 106-124; Beibl. (1891) 280.  
*Jahn, Hans und Moller.* Ztsch. physikal. Chem. 13 (1894) 385-397.  
*Krüss, G.* Ztsch. f. physikal. Chem. 2 (1888) 312-337; 18 (1895) 559-562; Beibl. (1888) 789; (1896) 197.  
*Landolt, H., und H. Jahn.* Sitzb. Berliner Akad. (1892) 729-758; Beibl. (1893) 329.  
*Liebermann, C.* Ber. chem. Ges. 21 (1888) 2527.  
*Liveing, G. D., and Dewar, J.* Phil. Mag. (5) 34 (1892) 205-209; Beibl. (1893) 121.  
*Nasini, R.* Gazz. chim. Ital. 17 (1887) 48, 55; Jahresb. (1887) 377.  
 ——. Gazz. chim. Ital. (1890) 1; Jahresb. (1890) 388.  
 ——. Rend. Accad. Roma (4) 6a (1890) 211-215; Jahresb. (1890) 356.  
 ——. Rend. Accad. Roma (4) 6a (1890) 299-301.  
 ——. e Costa. Rend. Accad. Roma (4) 7a (1891) 623-631; Beibl. (1892) 146-148.  
*Perkin, W. H.* Chem. News 63 (1891) 18-21.  
 ——. J. Chem. Soc. (5) 61-62 (1892) 287-310; Beibl. (1893) 559.  
*Pringsheim, N.* Ber. deutsch. botan. Ges. 4 (1886) Heft 11.  
 ——. Sitzb. Berliner Akad. (1887) 763-777; Beibl. (1888) 105.  
*Reinke, J.* Botan. Ztng. (1886) Nos. 9-14; Beibl. (1887) 709.  
*Sachs, J. von.* Beibl. (1888) 105.  
*Schramm, J., und J. Zakrezwski.* Monatsh. f. Chem. 8 (1887) 299-309.  
*Smith, C. M.* Proc. Roy. Soc. Edinb. 17 (1889-1890) 121-127; Beibl. (1890) 619.  
*Soret, J. L., et Rilliet, A. A.* C.-R. 110 (1890) 137-139; Beibl. (1890) 373.  
*Spring, W.* Bull. Acad. Belg. (3) 32 (1896) 43-51.  
 ——. Bull. Acad. Belg. (3) 37 (1897) 165-195.



- Staigmüller, H.* Beibl. (1897) 28.  
*Thumm, K.* Beibl. (1895) 786.  
*Tichimirow, W. A.* Jahresb. (1888) 442.  
*Tschirch, A.* Naturwiss. Rundsch. 11 (1896) 240-242.  
*Udransky, L. von.* Jahresb. (1888) 1524-1532.  
*Verschaffelt, J.* Bull. Acad. Belg. (3) 27 (1894) 69-84; Beibl. (1894) 833.  
*Wiedemann, E., und G. C. Schmidt.* Jahrb. f. Photogr. u. Reprod. (1896) 14-15.  
*Wroblewsky, A.* Beibl. (1897) 513.  
*Zettinow.* Beibl. (1894) 762.

## OSMIUM.

- Humphreys, W. J.* Astrophys. J. 6 (1897) 169-232.  
*Rowland, H. A., and R. R. Tatnall.* Astrophys. J. 2 (1895) 184-187; Beibl. (1896) 365

## OXYGEN.

- Bacchi, P.* Mem. Spettr. Ital. 28 (1899) 97-102, 121-129; Beibl. (1899) 636.  
*Bell, L.* Amer. Chem. J. 7 (1885) 32-34.  
*Berthelot.* Ann. chim. phys. (7) 16 (1899) 320-324.  
*Bruhl, J. W.* Ztsch. physikal. Chem. 25 (1898) 577-650; 26 (1898) 47-76.  
*Budde, E.* Verh. d. physikal. Ges. (1888) 89-96; 7 (1889) 89-96.  
*Conrady, E.* Ztsch. f. physikal. Chem. 3 (1889) 210.  
*Deslandres, H.* C.-R. 106 (1888) 842-856.  
*Dewar, J.* Beibl. (1890) 279, 284.  
*Dunér, N. C.* C.-R. 117 (1893) 1056-1059; Beibl. (1894) 562; Astron. and Astrophys. (1894) 215-218.  
*Eder, J. M.* Wiener Anzeiger (1890) 103-105; Monatsh. f. Chem. 11 (1890) 151-153.  
 — — — Wiener Anzeiger (1892) 44-47.  
 — — — Denschr. d. Wiener Akad. 60 (1893) 24 pp.; Beibl. (1894) 910-912.  
*Eisig, L.* Ann. Phys. n. F. 51 (1894) 747.  
*Fahrig, E.* Chem. Centralbl. (4) 2 (1890) 329; Chem. News 62 (1890) 39.  
*Gill, D.* Astrophys. J. 10 (1899) 272-282.  
*Grünwald, A.* Astron. Nachr. (1887) 201-214; Beibl. (1888) 245.  
*Hartley, W. N.* Nature 38 (1888) 474-477; Beibl. (1889) 509.

- Hartley, W. N.* (*Cont'd*). *Proc. Roy. Soc.* 60 (1896) 216-221.
- Hasselberg, B.* *Ann. Phys. n. F.* 52 (1894) 758; *Astron. and Astrophys.* 13 (1894) 760-763.
- Higgs, G.* *Proc. Roy. Soc.* 54 (1893) 200-209; *Beibl.* (1894) 338.
- Hüfner, G.* *Beibl.* (1894) 913.
- Janssen, J.* *C.-R.* 106 (1888) 1118-1119; 107 (1888) 672-677; 118 (1894) 757-760, 1007-1009; 120 (1895) 1306-1310; *Beibl.* (1888) 527; (1889) 383, 682; (1890) 617; (1894) 751, 837; (1896) 534.
- Jewell, L. E.* *Astrophys. J.* 5 (1897) 99-100.
- Leduc, A.* *C.-R.* 123 (1896) 805-807.
- Lenard, Ph., und Wolf, M.* *Ann. Phys. n. F.* 34 (1888) 918.
- Liveing, G. D., and J. Dewar.* *Nature* 36 (1887) 383; *Proc. Roy. Soc.* 43 (1887) 340-347.
- , ———. *Phil. Trans.* 179 I (1888) 27-42; *Beibl.* (1889) 216.
- , ———. *Phil. Mag.* (5) 26 (1888) 286-291; *Beibl.* (1889) 16.
- , ———. *Proc. Roy. Soc.* 46 (1889) 222-230; *Beibl.* (1889) 946.
- , ———. *Phil. Mag.* (5) 34 (1892) 205-209; *Beibl.* (1893) 121.
- , ———. *Phil. Mag.* (5) 37 (1894) 235-249; *Beibl.* (1895) 60.
- , ———. *Phil. Mag.* (5) 39 (1895) 268-272; *Beibl.* (1896) 193.
- McClellan, F.* *Proc. Roy. Soc.* 62 (1898) 417-423.
- Nasini, R., e G. Carrara.* *Gazz. chim. Ital.* 24 (1894) 256-291; *Beibl.* (1894) 834.
- Neovius, O.* *Svensk. Akad. Handl.* 17 (1891) 69 pp.; *Beibl.* (1893) 563.
- Olszewski, K.* *Sitzb. Wiener Akad.* 95 II (1887) 257-261.
- — et *Witkowski, A.* *Beibl.* (1894) 665.
- Otto, M.* *C.-R.* 123 (1896) 1005-1007; *Beibl.* (1897) 131.
- —. *La Nature* 26 (1898) 209-290; *Beibl.* (1898) 847.
- Paterson, D.* *J. Chem. Soc.* 67 (1895) 66-68.
- Pringsheim, N.* *Ber. botan. Ges.* (1886) Heft 11; *Beibl.* (1887) 257.
- —. *Sitzb. Berliner Akad.* (1887) 763-777; *Beibl.* (1888) 105.
- Ramsay, W., and M. W. Travers.* *Proc. Roy. Soc.* 62 (1898) 225-232; *Beibl.* (1898) 217.
- Runge, C., und F. Paschen.* *Astrophys. J.* 4 (1896) 317-319; *Beibl.* (1897) 518.
- , ———. *Ann. Phys. n. F.* 61 (1897) 641-686.
- Schuster, A.* *C.-R.* 118 (1894) 137-138; *Beibl.* (1894) 562.
- —. *Nature* 57 (1897) 320-321; *Beibl.* (1898) 400.
- Spring, W.* *Ztsch. f. anorg. Chem.* 8 (1895) 424-434.
- Sundell, A. F.* *Phil. Mag.* (5) 24 (1887) 98.
- Traube, J.* *Ber. chem. Ges.* 30 (1897) 38-43.

- Troubridge, J., and Hutchins, C.* Amer. J. Sci. (3) 34 (1887) 263-271.  
 ——. Amer. J. Sci. (4) 1 (1896) 329-333.  
*Wilde, H. C.-R.* 125 (1897) 708-709; Chem. News 76 (1897) 265,  
 288

## PALLADIUM.

- Humphreys, W. J.* Astrophys. J. 6 (1897) 169-232.  
*Rouland and Tatnall.* Astrophys. J. 3 (1896) 286-291.

## PARAGENIC WAVES

- Meslin, G. C.-R.* 118 (1894) 853-856; 119 (1894) 214-217.

## PHOSPHORESCENCE.

- Bardetscher, G. A.* Diss. Bern. 1889; Beibl. (1892) 742.  
*Becquerel, H. C.-R.* 112 (1891) 557-563; Beibl. (1891) 419.  
*Beddard, F. E.* Nature 60 (1899) 52.  
*Berthelot.* Ann. chim. phys. (6) 14 (1888) 429-432.  
*Burbank, J. E.* Amer. J. Sci. (4) 5 (1898) 53-55.  
*Campanile, F., e Stromer, E.* Nuov. Cim. (4) 3 (1896) 229; 6 (1897)  
 417-421.  
*Charpentier, A. C.-R.* 124 (1897) 304, 307, 356-359.  
*Crookes, W.* Chem. News 55 (1887) 25, 27, 107-110, 119-121, 131-  
 132; 56 (1887) 59, 62, 72, 81; Beibl. (1888) 195.  
 ——. Chem. News 79 (1889) 212; 80 (1899) 49-52.  
*Cusack, R.* Nature 56 (1897) 102; Beibl. (1897) 978.  
*Deaur, J.* Beibl. (1890) 284; (1893) 336.  
 ——. Chem. News 70 (1894) 252-253; Beibl. (1895) 336.  
*Dittrich, R.* Beibl. (1888) 857.  
*Dubois, R. C.-R.* 111 (1890) 363-366; 123 (1896) 653-654; Beibl.  
 (1897) 32, 590.  
*Eder, J. M.* Beibl. (1887) 822.  
*Elster, J., und H. Geitel.* 10 Jahresb. Ver. Naturw. Braunschweig  
 1897, 7 pp.  
*Fahrig, E.* Beibl. (1890) 1103.  
*Garbasso, A.* Nuov. Cim. 4 (1896) 159-162; Beibl. (1896) 985.  
*Henry, Ch. C.-R.* 115 (1892) 505-507; 122 (1896) 312-314, 123  
 (1896) 400-401.  
 ——. et G. Seguy. C.-R. 122 (1896) 1198-1200.  
*Hillebrand, F. W.* Ztsch. f. Kryst. u. Min. 30 (1898) 393.  
*Jackson, H. J. Chem. Soc.* 55-56 (1894) 743-744; Phil. Mag. (5) 46  
 (1898) 402-414.

- Joubain, L.* Bull. Soc. Zool. de France 13 (1893) 6 pp.  
*Kann, L.* Phys. Rev. 8 (1899) 250-251; Beibl. (1899) 486.  
*Kester, F. E.* Phys. Rev. 9 (1899) 164-176.  
*Killing, C.* Beibl. (1897) 863.  
*Klar, K.* Beibl. (1887) 777.  
*Klatt, V., und Ph. Lenard.* Ann. Phys. n. F. 38 (1889) 90-107.  
*Knoblauch, O.* Beibl. (1891) 650.  
*König, W.* Beibl. (1898) 563.  
*Kreutz, F.* Beibl. (1895) 636.  
*Krone, H. von.* Beibl. (1897) 31, 978.  
*Krusa, O.* Beibl. (1893) 1070.  
*Kutscher, F.* Ztsch. physiolog. Chem. 23 (1897) 109-114; Beibl. (1898) 316.  
*Living, G. D., and J. Dewar.* Phil. Mag. (5) 26 (1888) 286-291.  
*Lommel, E.* Ann. Phys. n. F. 30 (1887) 47, 473-487.  
 ——. Ann. Phys. n. F. 40 (1890) 681, 687.  
*Lumière, A. et L.* C.-R. 128 (1899) 549-552.  
*Maltezos, C.* C.-R. 124 (1897) 1147-1148.  
*Maurer, J.* Meteorol. Ztsch. 15 (1898) 108-109; Beibl. (1898) 401.  
*Mercanton, P. L.* Beibl. (1898) 778.  
*Mourelo, J. R.* C.-R. 124 (1897) 1024-1026; Beibl. (1897) 634.  
 ———. C.-R. 124 (1897) 1521-1523; 128 (1899) 557; Beibl. (1897) 741.  
 ———. C.-R. 126 (1898) 420-423, 904-906, 1508-1510; 17 (1898) 229-232, 361-364, 372-374; 128 (1899) 427-429, 557-559, 1239-1241; Beibl. (1898) 847; (1899) 252, 485.  
*Niewenglowski, G. H.* Paris: Desforges 1896, 23 pp.; C.-R. 122 (1896) 385-386.  
*Otto, M.* C.-R. 123 (1896) 1005-1007; Beibl. (1897) 131.  
*Pictet, R.* C.-R. 119 (1894) 527-529; Beibl. (1895) 244.  
*Pope, W. J.* Beibl. (1896) 373.  
*Precht, J.* Photogr. Rundschau 9 (1895) 320-324.  
*Provenzali, F. S.* Beibl. (1891) 131-138.  
*Ritsert, E.* Beibl. (1890) 984.  
*Sagnac, G.* J. de phys. (3) 5 (1896) 193-202.  
*Sandrucci, A.* Nuov. Cim. 6 (1897) 322-325.  
*Seguy, G.* C.-R. 121 (1895) 198-199; 125 (1897) 602-603.  
*Smith, C. M.* Beibl. (1893) 1070.  
*Thompson, S. P.* Phil. Mag. (5) 41 (1896) 103-107.  
 ———. Nature 56 (1897) 126. (Fire-fly light.)  
*Thorpe, T. E.* Nature 41 (1890) 523-524; Beibl. (1890) 622.

- Troubridge, C. C.* Sci. 9 (1899) 245-249.  
 —, J., and *J. E. Burbank.* Phil. Mag. (5) 45 (1898) 100-102.  
*Verneuil, A.* C.-R. 104 (1887) 501-504; Beibl. (1887) 438.  
 — —. C.-R. 106 (1888) 101-104, 1104-1107; Beibl. (1888) 476;  
 (1889) 19.  
*Villari, E.* Nuov. Cim. (3) 29 (1891) 36-42; Beibl. (1891) 517.  
*Wadsworth, F. L. O.* Astrophys. J. 4 (1896) 308; 6 (1897) 153-155.  
*Wiedemann, E.* Ann. Phys. n. F. 34 (1888) 446-469.  
 — —. Eder's Jahrb. f. Photogr. 5 (1891) 587-591; Beibl. (1891)  
 281.  
*Wolf, M., und P. Lenard.* Eder's Jahrb. (1889) 8 pp.; Beibl. (1889)  
 221.  
*Zettnow.* Jahrb. f. Photogr. u. Reprod. 8 (1894) 323.

## PHOSPHORUS.

- Berghoff, V.* Diss., Marburg, 1893; Beibl. (1895) 327.  
*Gramont, A. de.* C.-R. 122 (1896) 1534-1537.  
*Kowalewski, W. A.* Beibl. (1897) 968.  
*Lommel, E.* Sitzb. Muenchener Akad. (1888) 397-403.  
*McClean, F.* Soc. franç. de phys. (1892) 165-166.  
*Niewenglowski, G. H.* C.-R. 122 (1896) 232-233.  
*Pedler, A.* J. Chem. Soc. 57 (1890) 599-613; Beibl. (1890) 1101.  
*Thorpe, T. E.* Proc. Roy. Inst. Gt. Brit., March 14, 1890; Beibl.  
 (1890) 622.  
*Wilson, Benj.* London 1775, 4to. "The more refrangible rays excite  
 the phosphorescence of sulfuret of lime, but the less refrangible  
 ones extinguish it when shining."  
*Zecchini, F.* Gazz. chim. Ital. 33 (1893) 97-109, 109-121; Beibl.  
 (1893) 741.  
 — —. Gazz. chim. Ital. 34 (1894) 34-42; 37 (1897) 358-384.

## PHOTOGRAPHS OF THE SPECTRUM.

- Abney, W. de W.* Proc. Roy. Soc. 60 (1896) 13-15; Beibl. (1897) 981.  
*Angström, K.* Phys. Rev. 3 (1895) 138-141; Beibl. (1896) 196.  
*Baldrick, J. H., and A. Rood.* Brit. J. Photogr. 42 (1895) 805-806.  
*Baldwin, C. W.* Phys. Rev. 3 (1896) 370-380, 448-458.  
*Bonacini, C.* Mem. Spettr. Ital. 23 (1894) 146-154.  
*Bothamley, C. H.* Chem. Industr. J. (Manchester, Eng.) (1887) 423;  
 Jahresb. (1887) 2723.  
 — — —. Engineering 60 (1895) 566.

- Burbank, B.* Phil. Mag. (5) 26 (1888) 391-393; Beibl. (1888) 219.
- Carbutt, J.* Wilson's Photogr. Mag. 34 (1897) 221-225.
- Crew, H.* Astrophys. J. 2 (1895) 318-320.
- Crova, A.* C.-R. 116 (1893) 672-674; Beibl. (1894) 193.
- . C.-R. 116 (1893) 1343-1346; Beibl. (1893) 1043.
- Donle, W.* Ann. Phys. n. F. 34 (1888) 801-827.
- Draper, J. W.* Phil. Mag. (5) 3 (1877) 86; Jahresb. (1877) 195.
- Dumoulin, E.* Paris: Gauthier-Villars, 1894, 58 pp.
- Eder, J. M.* Sitzb. Wiener Akad. 92 II (1885) 346; 93 (1886) 4; 94 (1887) 75.
- . Brit. J. Photogr. 42 (1895) 391-392; Jahrb. f. Photogr. (1896) 166-168.
- Englisch, E.* Verh. d. Ges. deutsch. Naturf. u. Aertze II 1 (1899) 171-172.
- Fabre, C., et Andoyer.* C.-R. 113 (1891) 60-62.
- Gothard, E.* Mem. Spettr. Ital. 21 (1892) 1-5; Beibl. (1893) 754.
- . Jahrb. f. Photogr. (1893) 102-103; Beibl. (1893) 1067.
- Greenwich Spectroscopic Results.* Beibl. (1889) 218.
- Hale, G. E.* Astrophys. J. 1 (1895) 435-438.
- Hartley, W. N.* Rept. Brit. Assoc. (1885) 276-284; Beibl. (1888) 194.
- . Proc. Roy. Soc. 46 (1889) 88-90.
- Heen, P. de.* Bull. Acad. Belg. (3) 33 (1897) 205-210, 800-802; C.-R. 124 (1897) 459-460.
- Hermann, Th. S.* Ann. Phys. n. F. 59 (1896) 91-115.
- Higgs, G.* Rept. Brit. Assoc. (1890) 760; Beibl. (1892) 279.
- . Proc. Roy. Soc. 49 (1891) 345-346; Beibl. (1891) 518.
- Hübl, A.* Jahrb. Photogr. u. Reprod. (1897) 56-59.
- Huggins, W.* Astrophys. J. 5 (1897) 8-10.
- Hutchins, C. C.* Amer. J. Sci. (3) 34 (1887) 58-59.
- Ives, F. E.* Photo Times (1895) 180-182; Edinburgh Trans. (5) 14 (1896) 136-151.
- Izarn.* C.-R. 116 (1893) 572-574; 121 (1895) 884-886; Beibl. (1893) 1071; (1896) 653.
- Janssen, J.* C.-R. 116 (1893) 456-458.
- Joly, J.* Proc. Roy. Soc. Dublin (2) 6 (1898) 127-138; Beibl. (1899) 253.
- Keeler, J. E.* Astrophys. J. (1895) 101-111.
- Kelvin, Lord.* Nature 54 (1896) 12-13.
- Konkoly, N. von.* Centralztng. f. Opt. u. Mech. 8 (1887) 241-242; 15 (1894) 73-74.

- Krone, H.* Photogr. Mittheil. 29 (1892) 67-70; 30 (1893) 133-135 148-150.
- Le Bon, G.* C.-R. 122 (1896) 188-190, 233-235.
- Lippman, G.* C.-R. 112 (1891) 274-275; Beibl. (1891) 282.
- —. C.-R. 114 (1892) 961-962; Beibl. (1892) 611.
- —. C.-R. 115 (1892) 575-576; Beibl. (1893) 933.
- —. J. de phys. (3) 3 (1894) 97-107; Beibl. (1894) 761.
- —. Proc. Roy. Soc. 60 (1896) 10-13; Beibl. (1897) 418.
- —. Bull. Soc. astron. France (1897) 280-283.
- Lockyer, J. D.* Proc. Phil. Soc. Cambridge 9 (1896) 141-142.
- —, *J. N.* Proc. Roy. Soc. 52 (1892) 326-331; Beibl. (1893) 830.
- — —. Proc. Roy. Soc. 54 (1893) 359-361.
- — —. Astron. and Astrophys. 13 (1894) 574-575.
- — —. Proc. Roy. Soc. 54 (1894) 139-141; Beibl. (1894) 767.
- — —. Phil. Trans. 185 (1895) 983-1023, 1023-1029.
- Lommel, E.* Sitzb. Muenchener Akad. (1888) 397-403; (1889) 83-87.
- Lumière, A. et L.* C.-R. 124 (1897) 1438-1440; Beibl. (1897) 965.
- McClean, F.* Soc. franç. de phys. (1892) 165-166; Beibl. (1894) 568.
- Marey.* Soc. franç. de phys. (1893) 5.
- Mascart et Bouasse.* C.-R. 111 (1890) 83-84; Beibl. (1890) 905.
- Michelson, A. A.* Astrophys. J. 1 (1895) 1-9; Beibl. (1895) 428.
- Mouchez.* C.-R. 111 (1890) 5-6; Beibl. (1890) 789.
- Neuhauss, R.* Jahrb. f. Photogr. (1897) 179-185; Beibl. (1898) 844.
- —. Jahrb. f. Photogr. (1899) 70-74.
- Niewenglowski, G. H.* Paris; Desforges, 1896, 23 pp.
- Nodon* Éclairage électr. 8 (1896) 321-322.
- Oppolzer, E. von.* Sitzb. Wiener Akad. 107 II (1898) 1477-1493; Astrophys. J. 9 (1899) 317-331.
- Paige, C. Le.* Bull. Acad. Belg. (3) 34 (1897) 429-437, 802-803.
- Pickering, E. C.* Rept. Brit. Assoc. (1887) 622; Beibl. (1887) 637.
- — —. Astrophys. J. 1 (1895) 27-28, with plate.
- — —. Annals Harvard Observ. 32 I (1895) 114 pp.
- Porcher, Ch.* C.-R. 125 (1897) 409-410.
- Precht, J.* Photogr. Rundsch. 9 (1895) 320-324; Beibl. (1896) 203.
- Preston, Th.* Nature 57 (1897) 173; Beibl. (1898) 355.
- Rayleigh, Lord.* Rept. Brit. Assoc. (1889) 493.
- —. Phil. Mag. (5) 31 (1891) 87-99; Beibl. (1891) 562.
- Reports on Spark Spectra.* Rept. Brit. Assoc. (1885) 276-284.
- Riccó, A.* Mem. Spettro. Ital. 24 (1895) 21-30. Astrophys. J. 1 (1895) 18-26.
- Rowland, H. A.* Chem. News 59 (1889) 124-125; Beibl. (1889) 682.



*Sagnac, G.* C.-R. 125 (1897) 168-171.

*Schaeberle, J. M.* Lick Observ. Contrib. No. 3 (1893) 89 pp.; Beibl. (1893) 650.

*Scheiner, J.* Astron. Nachr. 121 (1889) 49-62; Beibl. (1889) 886.

———. Astron. Nachr. 122 (1889) 321-344; 124 (1890) 273-278, 279-282; 128 (1891) 113-122; 133 (1893) 73-80; Sitzb. Berliner Akad. (1890) 143-151; (1894) 433-442; Pub. Observ. Potsdam 7 II (1895) 171-335.

*Schütt, F.* Ann. Phys. n. F. 57 (1895) 533-554.

———. Mon. Not. 56 (1896) 278-281.

*Schumann, V.* Eder's Jahrb. 4 (1890) 158-163; Beibl. (1890) 615.

———. Chem. News 62 (1890) 299; Beibl. (1891) 205.

———. Chem. News 63 (1891) 33-34; Beibl. (1891) 281.

———. Chem. News 64 (1891) 275; Beibl. (1892) 278.

———. Photogr. Rundsch. (1892) 33 pp.

———. Wiener Anzeiger (1892) 231.

———. Sitzb. Wiener Akad. 102 IIa (1893) 994-1024; Beibl. (1894) 456.

———. Jahrb. f. Photogr. u. Reprod. 9 (1895) 198-201; 10 (1896) 42-45; Beibl. (1896) 648, 975.

———. Sitzb. Wiener Akad. 102 (1893) 475-515, 625-694; Beibl. (1894) 187.

———. Astrophys. J. 3 (1896) 144-155, 220-226, 387-394.

———. Eder's Jahrb. 11 (1897) 20-22, 24-25; Beibl. (1897) 841, 973.

*Simon, H. Th.* Ann. Phys. n. F. 59 (1896) 91-115.

*Smyth, C. P.* Rept. Brit. Assoc. (1890) 750-751; Beibl. (1892) 279.

———. Rept. Brit. Assoc. (1891) 573.

*Valenta, E.* Verh. deutsch. Naturf. u. Aerzte II (1895) 78-79.

*Vogel, H. W.* Sitzb. preuss. Akad. 51 (1886) 1205-1208; Beibl. (1887) 255.

———. Verh. d. physikal. Ges. Berlin 10 (1891) 33-35; Beibl. (1891) 560.

———. Photogr. Mittheil. 31 (1895) 367-369; Beibl. (1895) 422.

———. Verh. d. phys. Ges. Berlin 16 (1897) 176-178.

———. Eder's Jahrb. 11 (1897) 217-220; Beibl. (1897) 982.

*Zenger, Ch. V.* C.-R. 103 (1886) 454-456; Beibl. (1887) 94.

———. C.-R. 109 (1889) 434-436; Beibl. (1890) 37.

PHOTOMETRY, see SPECTROPHOTOMETRY, below.

## PHYSIOLOGICAL.

- Abney, W. de W. Proc. Roy. Soc. 49 (1891) 509-518.  
 ———. Nature 47 (1893) 538-542.  
 ———. Proc. Roy. Soc. 61 (1897) 330-331; Beibl. (1898) 409.  
 Blake, J. Ztsch. f. physikal. Chem. 5 (1890) 217-220.  
 Campbell, W. W. Astrophys. J. 9 (1899) 312-317; 10 (1899) 22-25.  
 Fechner, G. Th. Ztsch. f. Psychol. u. Physiol. 1 (1890) 26-46.  
 Friedrich, E. Wiener Anzeiger (1898) 2.  
 Fuchs, S., und A. Kriegl. Centralbl. f. Physiol. (1896) Heft 9.  
 Handl, A. Sitzb. Wiener Akad. 94 (1886) 935-946; Beibl. (1887) 585.  
 Helmholtz, H. von. Ztsch. f. Psychol. u. Physiol. 1 (1890) 5-17; 2 (1891) 30; 3 (1891) 20.  
 Henry, C. C.-R. 122 (1896) 951-954; Beibl. (1896) 702.  
 Hering, E. Archiv. f. d. gesamt. Physiol. 54 (1893) 277-312.  
 König, A. Sitzb. Berliner Akad. (1897) 559-575, 720-731.  
 ———. Verh. d. physikal. Ges. Berlin 16 (1897) 128.  
 Kries, J. von. Ztsch. Psychol. u. Physiol. 12 (1896) 81-102.  
 Lambling, E. Jahresb. (1889) 255.  
 Leroy, C. J. C.-R. 116 (1893) 377-379.  
 Martins, G. Leipzig: W. Engelmann, 1897, pp. 161-273; Beibl. (1898) 408.  
 Mascart, C.-R. 113 (1891) 180-181.  
 Preyer, W. Ztsch. f. Psychol. u. Physiol. 11 (1886) 405-408.  
 Rayleigh, Lord. Rept. Brit. Assoc. (1890) 728-729.  
 Robinson, T. R. Amer. J. Psychology 7 (1896) 518-532.  
 Sachs, M. Ztsch. f. Psychol. u. Physiol. 4 (1893) 421.  
 Sirks, J. L. Astron. and Astrophys. 13 (1894) 763-768.  
 Smyth, C. P. Rept. Brit. Assoc. (1891) 573.  
 Stanley W. F. Chem. News 67 (1893) 71-72.  
 Stoney, G. J. Proc. Dublin Soc. 8 (1894) 228-244.  
 Strehl, K. Ztsch. f. Instrum. 7 (1897) 77-81.  
 Takizawa, K. J. Coll. Sci. Japan 5 (1892) 193-196.  
 Tscherning. Soc. franç. de phys. (1892) 288-296.  
 Uthoff, W. Ztsch. f. Psychol. u. Physiol. 1 (1890) 155-160.  
 ———. Verh. d. physikal. Ges. Berlin 8 (1889) 9-12.  
 Vogel, H. W. Naturwiss. Rundschau 3 (1888) 185-186, 220.  
 ———. Verh. d. physikal. Ges. Berlin (1890) 1-8.  
 ———. Ann. Phys. n. F. 54 (1895) 668-674, 745-751.

*Vogel, H. W. (Cont'd).* Verh. deutsch. Naturf. u. Aerzte II 1 (1898) 44-47.

*Widmark.* Nordisk. Ophthalmol. Tidskrift 3 (1890) 3; Archiv. f. Physiol. 3 (1891) 463-502.

## PLATINUM.

*Aubel, E. van.* Bull. Acad. Belg. (3) 11 (1886) 408-414; 12 (1886) 665; Jahresb. (1886) 288.

*Cross, C. R.* Proc. Amer. Acad. (1886) 220-226; Beibl. (1887) 338.

*Hodgkinson, W. R.* Chem. News 58 (1888) 187, 223-224.

*Humphreys, W. J.* Astrophys. J. 6 (1897) 169-232.

*Hutchins, C. C., and E. S. Holden.* Phil. Mag. (5) 24 (1887) 325-330; Beibl. (1888) 473-475.

*Kayser, H.* Abhandl. d. Berliner Akad. (1897) 44 pp.; Astrophys. J. (1898) 93-114, 173-198.

*Kurlbaum, F.* Verh. d. physikal. Ges. Berlin (1896) 56-70; Beibl. (1896) 690.

— —. Ann. Phys. n. F. 67 (1899) 846-858.

*Panchen, F.* Ann. Phys. n. F. 49 (1893) 50.

*Paquelin.* C.-R. 113 (1891) 384-385.

*Reid, H. F.* Astrophys. J. 2 (1895) 160-161; Beibl. (1896) 27.

*Rizzo, G. B.* Nuov. Cim. 35 (1894) 22-31; Beibl. (1893) 1059.

*Rowland, H. A., and R. R. Tatnall.* Astrophys. J. 2 (1895) 184-187; Beibl. (1896) 365.

*Stoessel, J.* Beibl. (1889) 945.

*Violle, J.* C.-R. 105 (1887) 163-165; Beibl. (1887) 702.

*Zeeman, P.* Zitt. Akad. Amsterdam (1895-1896) 116-119; Beibl. (1896) 528.

## POLONIUM.

*Curie, Sk.* Rev. gen. des. Sci. 10 (1899) 41-50.

*Giesel, F.* Physikal. Ztsch. 1 (1899) 16-17.

## POTASSIUM.

*Beaulard, F.* C.-R. 123 (1896) 301-302.

*Bender, C.* Ann. Phys. n. F. 39 (1890) 89.

*Boisbaudran, F. Lecoq de.* C.-R. 124 (1897) 1288-1290, 1419-1421; Beibl. (1897) 735.

*Deslandres, H.* C.-R. 106 (1888) 739-740; Beibl. (1888) 854.

*Eder, J. M., und E. Valenta.* Denkschr. d. Wiener Akad. 60 (1893) 467-476; Beibl. (1894) 909.

—, —. Denkschr. d. Wiener Akad. 61 (1894) 347-364; Beibl. (1894) 1046.

- Freeman, J. H.* Chem. News 18 (1868) 1; Jahresb. (1868) 129.  
*Giesel, F.* Ber. chem. Ges. 30 (1897) 156-158; Beibl. (1897) 337.  
*Gooch, F. A., and Hart, T. S.* Amer. J. Sci. (3) 42 (1891) 448-459; Beibl. (1892) 278.  
*Gramont, A. de.* C.-R. 122 (1896) 1411-1413; Beibl. (1896) 693.  
*Hamburger, F.* Ann. Phys. n. F. 56 (1895) 173-174.  
*Hartley, W. N., and Ramage, H.* Proc. Roy. Soc. 60 (1896) 393; Proc. Chem. Soc. (1897) 11.  
*Humphreys, W. J.* Astrophys. J. 6 (1897) 169-232.  
*Sabatier, P.* C.-R. 118 (1894) 1260-1263; Beibl. (1894) 1048.  
*Schottlaender, P.* Liebig's Ann. 240 (1887) 346.  
*Schunck, C. A.* Chem. News 51 (1885) 152; Jahresb. (1885) 323.  
*Tommasi, D.* C.-R. 128 (1899) 1107.  
*Wiedemann, E., und G. C. Schmidt.* Ann. Phys. n. F. 57 (1896) 447-453.

## PRESSURE, its effect on a spectrum.

- Ames, J. S., and W. J. Humphreys.* Johns Hopkins Univ. Cir. 16 (1897); Beibl. (1897) 974.  
*Carnazzi, P.* Nuov. Cim. 6 (1897) 385-401; Beibl. (1898) 661.  
*Corrigan, S. J.* Astron. and Astrophys. (1892) 108-119.  
*Dongier, R.* Soc. franç. de phys. (1896) 310-311.  
*Editor of Nature.* Nature 56 (1897) 415-416.  
*Ferry, E. S.* Phys. Rev. 7 (1898) 296-306; Beibl. (1899) 251.  
*Godfrey, C.* Astrophys. J. 8 (1898) 114.  
*Harzer, P.* Astron. Nachr. 141 (1896) 321-357.  
*Haschek, E., und H. Mache.* Sitzb. Wiener Akad. 107 II (1898) 253-265.  
*Heavyside, O.* Proc. Roy. Soc. 54 (1894) 26-30.  
*Humphreys, W. J., and J. P. Mohler.* Astrophys. J. 3 (1895) 114-118; Beibl. (1896) 583.  
 — — —. Astrophys. J. 4 (1896) 249-262.  
 — — —. Astrophys. J. 6 (1897) 169-232; Beibl. (1898) 219.  
*Janssen, J.* C.-R. 107 (1888) 672.  
*Jewell, L. E., J. F. Mohler, and W. J. Humphreys.* Astrophys. J. 3 (1896) 138-140.  
*Kulhane, A.* Ann. Phys. n. F. 65 (1898) 815-848.  
*Larmor, J.* Rept. Brit. Assoc. (1897) 555-556.  
*Living, G. D., and J. Dewar.* Phil. Mag. (5) 26 (1888) 286-291; Beibl. (1889) 16.  
 — — —. Chem. News 63 (1891) 155-156, Proc. Roy. Soc. 49 (1891) 143-145, 217-225; Beibl. (1891) 514.

- Lodge, O. J.* Phil. Mag. (5) 46 (1898) 414-426.  
*Mohler, J. F.* Astrophys. J. 4 (1896) 175-181; 10 (1899) 202-206.  
*Newall, H. F.* Proc. Cambridge Phil. Soc. 9 (1897) 295-303; Beibl. (1898) 172.  
*Perrin, J.* Soc. franç. de phys. (1896) 288.  
*Rayleigh, Lord.* Phil. Mag. (5) 45 (1898) 522-525.  
*Wilsing, J.* Astrophys. J. 7 (1898) 317-329. See Do. 3 (1896) 114; 4 (1896) 175, 249; 6 (1897) 169; and Godfrey, Do. 8 (1898) 114.  
 ——. Astrophys. J. 10 (1899) 269-271.

PURKINJE PHENOMENON, its influence on faint spectra.

- Campbell, W. W.* Astrophys. J. 8 (1898) 317-319; 10 (1899) 22-24.  
*Hering und Hillebrand.* Sitzb. Wiener Akad. (1889).  
*König, A.* Ann. Phys. n. F. 45 (1892) 607.  
*Schreiner.* Astrophys. J. 7 (1898) 295.

RADIUM.

- Curie, P., Mme. Curie, et G. Bemont.* C.-R. 127 (1898) 1215-1218; Beibl. (1899) 195.  
*Giesel, F.* Physikal. Ztsch. 1 (1899) 16-17.

RED END OF THE SPECTRUM.

- Angström, K.* Svensk. Kemisk. Tidskrift (1889) 98-108.  
 ——. Physikal. Rev. (1892) 597-624.  
*Nasini, Anderlini, e Salvadori.* Rend. Accad. Lincei Roma 8 (1899) 269-270.  
*Runge, C.* Astrophys. J. 9 (1899) 281-284.  
*Saunders, F. A.* Johns Hopkins Univ. Cir. 18 (1899) 58-59.

REFLEXION.

- Bouasse, H.* Ann. chim. phys. (6) 28 (1893) 145-237, 433-498.  
*Camerer, R.* Ztsch. f. Krystall. u. Min. 28 (1897) 623-624.  
*Carvallo, E.* Soc. franç. de phys. (1893) 290-299; Beibl. (1894) 576.  
*Cornely.* Ztsch. math. phys. Unterr. 9 (1896) 240; Beibl. (1896) 870.  
*Cornu, A.* C.-R. 108 (1889) 1211-1217.  
*Drude, P.* Ann. Phys. n. F. 47 (1893) 595; 51 (1894) 77; 53 (1894) 841.  
*Du Bois, H. E. J. G.* Ann. Phys. n. F. 46 (1892) 542.  
*Dufet, H.* Bull. Soc. min. de France 13 (1890) 271-276.  
 ——. J. de phys. (3) 1 (1892) 163-183; Beibl. (1892) 25.

- Fabry, Ch.* C.-R. 120 (1895) 314-317; Beibl. (1895) 637.  
*Glan, P.* Ann. Phys. n. F. 47 (1892) 252.  
*Gouy* C.-R. 124 (1897) 1146-1147.  
*Hecht, B.* Neues Jahrb. f. Min. Geol. u. Paleont. 1 (1887) 218-221; 2 (1887) 180-182; Beibl. (1888) 192.  
*Jadanza.* Atti Accad. Torino 26 (1890-1891) 459-466; Beibl. (1892) 200.  
*Janet, P.* J. de phys. (3) 1 (1892) 373-375.  
*Ketteler, E.* Ann. Phys. n. F. 56 (1895) 56-77.  
*Klaasen, Helen G.* Phil. Mag. 44 (1897) 349-356.  
*Kolacek, F.* Bohm. math. phys. Ztsch. 21 (1892) 119-127.  
*Lemeray, E. M.* J. de phys. 5 (1896) 272.  
*Mach, E., et J. Arbes.* Ann. Phys. n. F. 27 (1886) 346.  
*Malagoli e Banacini.* Atti Accad. Roma 5 (1896) 327-331.  
*Messerschmidt, J. B.* Ann. Phys. n. F. 34 (1888) 867-897.  
*Potier, A.* J. de phys. (2) 10 (1891) 349-357.  
*Prunhes, B.* Soc. franç. de phys. 3 (1895) 162-165.  
*Pulfrich, C.* Ann. Phys. n. F. 31 (1887) 724-734.  
 ——— Ann. Phys. n. F. 33 (1888) 209-212.  
 ——— Ztsch. f. Instrum. 13 (1893) 267-273.  
*Rayleigh, Lord.* Phil. Mag. (5) 34 (1892) 309-320.  
 ——— Rept. Brit. Assoc. (1893) 690-691.  
*Righi, I.* Rend. Accad. Roma 1 (1884) 1-5; Jahresb. (1886) 300.  
*Ritter, R.* Ann. Phys. n. F. 36 (1889) 236-264.  
*Rood, O. N.* Amer. J. Sci. (4) 2 (1896) 173-180.  
*Rosenthal, H.* Ann. Phys. n. F. 68 (1899) 783-800.  
*Rubens, H.* Ann. Phys. n. F. 37 (1889) 249.  
*Schott, G. A.* Phil. Trans. 185 (1895) 823-887.  
*Searle, A.* Astron. Nachr. 126 (1890) 115; Beibl. (1891) 646.  
*Seeliger, H.* Sitzb. Muenchener Akad. (1888) 201-248.  
*Silow, P.* Ztsch. phys. chem. Unterr. 9 (1896) 280-281; Beibl. (1897) 223.  
*Sirks, J. L.* Beibl. (1894) 457.  
*Sluginojj, N.* J. russ. phys. chem. Ges. 23 (1891) 427-430.  
*Soret, C.* Arch. de Geneve 26 (1891) 542-569.  
*Spurge, C.* Proc. Roy. Soc. 41 (1887) 242.  
*Voigt, W.* Ann. Phys. n. F. 35 (1888) 76-100.  
*Wehner, F. H.* Grunert's Archiv (2) 9 (1890) 337-374; Beibl. (1891) 210.  
*Wernicke, W.* Ann. Phys. n. F. 51 (1894) 448; 52 (1894) 515.  
*Wiener, Otto.* Ann. Phys. n. F. 31 (1887) 629-673.

## REFRACTION.

- Abati, G.* Gazz. chim. Ital. 27 (1897) 437-455; Beibl. (1898) 397.
- Abbot, Ch. G.* Amer. J. Sci. (4) 2 (1896) 255-257; Beibl. (1897) 407.
- Almy, J. E.* Phil. Mag. (5) 44 (1897) 499-503; Beibl. (1898) 156.
- Anderson, A.* Cambridge Proc. 9 (1896) 195-198.
- Bary, P.* C.-R. 114 (1892) 827-831; Beibl. (1892) 735.
- . C.-R. 118 (1894) 71-74.
- Basset, A. B.* Physikal. Rev. (1892) 481-512.
- Basso, G.* Nuov. Cim. 35 (1894) 17-22.
- Bauschinger, J.* Sitzb. Muenchener Akad. (1895) 239-260; Beibl. (1896) 685.
- Beaulard, F.* C.-R. 110 (1890) 1063-1066; 111 (1890) 173-176; 112 (1896) 782-783.
- Bender, C.* Ann. Phys. n. F. 39 (1890) 89; 68 (1899) 343-349.
- Bergstrand.* Oefvers. k. Vet. Akad. Forh. 54 (1897) 51-67.
- Bernstein, J.* Naturwiss. Rundsch. 10 (1895) 540.
- Blondlot, R.* C.-R. 106 (1888) 349-354.
- Borel, G. A.* C.-R. 120 (1895) 1404-1406; Beibl. (1896) 42.
- Borgesius, A. H.* Ann. Phys. n. F. 54 (1895) 221-243.
- Born, M.* N. Jahrb. Min., Geol. u. Paleont. (1887) 1-51, 5. Beilage.
- Bose, J. C.* Proc. Roy. Soc. 59 (1896) 160-167; 62 (1898) 293-300; Beibl. (1898) 348.
- Bouasse, H.* C.-R. 111 (1890) 100-102.
- . Ann. chim. phys. (6) 28 (1893) 145-237, 433-498.
- Bouty, E.* Soc. franç. de phys. 3 (1895) 218-222.
- Brace, D. B.* Phil. Mag. (5) 48 (1899) 345-360.
- Bruehl, J. W.* Liebig's Ann. 235 (1886) 1; Ber. chem. Ges. 19 (1886) 2746.
- . Ber. chem. Ges. 24 (1891) 555.
- Burbank, J.* Phil. Mag. (5) 26 (1888) 391-393.
- Burmeister, L.* Ztsch. Math. u. Phys. 40 (1895) 65-90, 321-336; Beibl. (1895) 617; (1896) 271.
- Carnazzi, P.* Nuov. Cim. 6 (1897) 385-401; Beibl. (1898) 661.
- Carrara, G.* Rend. Accad. Roma (5) 1 (1892) 19-25; Beibl. (1893) 116.
- Carvallo, E.* Beibl. (1891) 563.
- . C.-R. 120 (1895) 88-91.
- Cassie, W.* Proc. Roy. Soc. 49 (1891) 343-345.
- Cesaro, G.* Bull. Acad. Belg. (3) 22 (1892) 503-512.
- Chappuis, J.* C.-R. 114 (1892) 286-288; Beibl. (1892) 425.
- et *Ch. Rivière.* C.-R. 102 (1886) 1461; 103 (1886) 37.



- Cole, A. D. Phys. Rev. 4 (1896) 50-61.  
 Comstock, G. E. Astron. Nachr. 139 (1895) 135-138.  
 Conroy, J. Proc. Roy. Soc. 58 (1895) 228-234; Beibl. (1895) 881.  
 ——. Proc. Roy. Soc. 64 (1899) 308-318.  
 Costa, T. Gazz. chim. Ital. (1889) 478; Jahresb. (1890) 390.  
 ——. Rend. Accad. Roma 7 (1891) 308-313; Beibl. (1892) 424.  
 Cotton, A. C.-R. 128 (1899) 294-297; Beibl. (1899) 509.  
 Croft, W. B. Phil. Mag. (5) 38 (1894) 70-81; Beibl. (1894) 1001.  
 Czapski, S. Beibl. (1890) 993.  
 Dale, P. Phil. Mag. (5) 25 (1888) 325-338.  
 ——. Chem. News 62 (1890) 259; Beibl. (1892) 272.  
 Dijken, D. Diss., Gröningen, 1897; Beibl. (1897) 333, 970.  
 Doberck, W. Observ. 19 (1896) 268-270.  
 Dongier, R. C.-R. 122 (1896) 306-309.  
 ——. Soc. franç. de phys. (1896) 310-311.  
 Doumer, E. C.-R. 110 (1890) 40-42, 139-141, 957-958.  
 Du Bois, H. E. J. G., und Rubens, H. Sitzb. Berliner Akad. (1890) 955-968.  
 ——. Ann. Phys. n. F. 47 (1892) 203.  
 Dufet, H. Bull. Soc. min. de France, Sept. 1893, 31 pp.  
 Dussand, F. C.-R. 113 (1891) 291-292.  
 ——. Arch. de Genève 27 (1892) 380-405, 521-535; Beibl. (1896) 23.  
 Eder, J. M., und Valenta, E. Wiener Anzeiger (1892) 252-253.  
 Edwards, W. F. Amer. Chem. J. 16 (1894) 625-634; Beibl. (1895) 420.  
 ——. Amer. Chem. J. 17 (1895) 473-506; Beibl. (1896) 364.  
 Eykman, M. J. F. Rec. des trav. chim. des Pays Bas 15 (1896) 52-61; Beibl. (1897) 27.  
 Féry, Ch. C.-R. 119 (1894) 402-404; Beibl. (1895) 168.  
 Fizeau, Ch. Bull. Acad. Belg. (3) 7 (1884) 245; Jahresb. (1884) 293.  
 Forel, F. A. C.-R. 123 (1896) 161-162; Beibl. (1897) 511.  
 Friedel, G. C.-R. 122 (1896) 1051-1052.  
 Fuchbauer. Verh. deutsch. Naturf. u. Aerzte (1893) 19-22.  
 Galitzin, B. Bull. Acad. St. Petersb. (5) 3 (1895) 131; Beibl. (1896) 122.  
 Garbasso, A. Nuov. Cim. (4) 2 (1895) 120-122.  
 ——. Atti Accad. Roma 5 (1896) 8-10.  
 Gennari. Rend. Accad. Roma 3 (1894) 123-129.  
 Feronsi, B. T. Riv. Sci. 23 (1891) 221-226; Beibl. (1892) 274.  
 Ghira, A. Rend. Accad. Roma (5) 2 (1893) 312-319; Beibl. (1893) 1047.

- Chiusi, A. (Cont'd).* *Read. Accad. Roma* 3 (1894) 297-301.  
 ——. *Read. Accad. Roma* 3 (1894) 391-393; *Beibl.* (1894) 906;  
*Gazz. chim. Ital.* (1894) 314.  
*Gibbs, J. Willard.* *Amer. J. Sci.* (3) 35 (1888) 467-475; *Beibl.* (1888) 777.  
*Gladstone, J. H. and G.* *Rept. Brit. Assoc.* (1890) 772.  
 ——. *J. Chem. Soc.* 59-60 (1891) 290-301; *Beibl.* (1891) 552-555.  
 ——. *J. Chem. Soc.* 59 (1891) 589-598; *Beibl.* (1891) 764.  
 ——. *Rept. Brit. Assoc.* (1892) 679.  
 ——. *Phil. Mag.* (5) 35 (1893) 204-210.  
 ——. *Rept. Brit. Assoc.* (1895) 609-610.  
 ——. *Proc. Roy. Soc.* 60 (1896) 140-146; *Beibl.* (1897) 26.  
 ——. and *W. H. Herbert.* *Rept. Brit. Assoc.* (1891) 609; *Beibl.* (1892) 605.  
 ——. *J. Chem. Soc.* 67-68 (1895) 831-868; 71 (1897) 822-833.  
 ——. *Rept. Brit. Assoc.* (1889) 515.  
*Gleichen, A.* *Ann. Phys. n. P.* 35 (1888) 100-107.  
 ——. *Ztsch. Math. u. Phys.* 34 (1889) 161-176; *Beibl.* (1890) 14.  
*Goldhammer, D.* *J. russ. phys. chem. Ges.* 18 (1886) 239-267.  
*Götting, E.* *Ztsch. phys. chem. Unterr.* 9 (1896) 235-237; *Beibl.* (1896) 870.  
*Gouy, C.-R.* 122 (1896) 1197-1198; 123 (1896) 43-44.  
*Gravelaar, A. W.* *Ztsch. phys. u. chem. Unterr.* 3 (1890) 246-247.  
*Grimpen, A.* *Diss., Kiel*, 1890; *Beibl.* (1891) 110.  
*Gylden.* *Mem. Acad. St. Petersb.* (7) 10 (1866).  
*Hanke, A.* *Wiener Anzeiger* (1896) 176.  
*Hallwachs, W.* *Ann. Phys. n. F.* 50 (1893) 577; 53 (1894) 1; 68 (1899) 1-45.  
*Hartl.* *Medicin. Ztschr.* 16 (1881); *Mittheil. d. militair. geogr. Inst.* 3 (1883); 4 (1884).  
*Haschek, A.* *Sitzb. Wiener Akad. IIa* (1888) 958; *Jahresb.* (1888) 423.  
*Hasselberg, B.* *Oefvers. k. Vet. Akad. Forh.* 49 (1892) 441-449; *Beibl.* (1893) 915.  
*Hauke, A.* *Sitzb. Wiener Akad.* (1896).  
*Hausdorff, F.* *Ber. d. Sachs. Ges. d. Wiss.* (1891) 481-566; (1893) 120-162.  
*Hepperger, J. von.* *Sitzb. Wiener Akad.* 102 (1893) 321-355; *Beibl.* (1894) 554.  
*Higgs, G.* *Rept. Brit. Assoc.* (1890) 760; *Beibl.* (1892) 279.

- Higgs, G.* Proc. Roy. Soc. 49 (1891) 345-346; Beibl. (1891) 518.
- Hlawatsch, G.* Ztsch. f. Kryst. 27 (1897) 605-607; Beibl. 21 (1897) 511.
- Jahn, H., und Moller, G.* Ztsch. f. physikal. Chem. 13 (1894) 385-397.
- Joubin, P.* C.-R. 115 (1892) 1061-1063.
- Jung.* Centralztng. f. Opt. u. Mech. 14 (1893) 2-3.
- Kanonnikoff, J.* J. russ. phys. chem. Ges. 30 (1899) 965-975; Beibl. (1899) 768.
- Kath, H.* Ann. Phys. n. F. 62 (1897) 328-352.
- Keeler, J. E.* Astrophys. J. 9 (1899) 133-142.
- Kelvin, Lord.* Nature 58 (1898) 546; Rept. Brit. Assoc. (1898) 782-783.
- —. Proc. Roy. Soc. Edinb. (1899) 366-379; Phil. Mag. (5) 47 (1899) 179-191.
- Ketteler, E.* Ztsch. phys. Chem. 2 (1888) 905.
- —. Ann. Phys. n. F. 49 (1893) 509.
- Knops, C.* Liebig's Ann. 248 (1888) 175-231.
- König, A.* Diss., Jena, 1895, 45 pp.
- —. Ztsch. phys. u. chem. Unterr. 8 (1895) 260-264; Beibl. (1896) 528.
- Königsberger, J.* Ann. Phys. n. F. 61 (1897) 687-704.
- Konowalow, M.* J. russ. phys. chem. Ges. (7) 27 (1897) 412-421; Beibl. (1897) 966.
- Koppe, M.* Centralztng. f. Opt. u. Mech. 11 (1890) 30-31.
- Kowalewski, W. A.* J. russ. phys. chem. Ges. 29 (1897) 217-222; Beibl. (1897) 968.
- Kuhfahl.* Ztsch. phys. chem. Unterr. 6 (1892-1893) 301; Beibl. (1894) 554.
- Kundt, A.* Ann. Phys. n. F. 27 (1886) 59; Jahresb. (1886) 300.
- —. Sitzb. Berliner Akad. (1888) 255; Jahresb. (1888) 424.
- Kurz, A.* Repert. d. Phys. 26 (1890) 177-178; Ztsch. f. Math. u. Phys. 37 (1892) 317-318; 38 (1893) 319-320; Beibl. (1894) 183.
- Lagerborg, N.* Beibl. (1889) 490.
- Lallemand, Ch.* C.-R. 123 (1896) 222-225, 297-301; Beibl. (1897) 226.
- Lampa, A.* Sitzb. Wiener Akad. 105 IIa (1896) 589-600; Wiener Anzeiger (1896) 175-176.
- Landolt, H., und H. Jahn.* Sitzb. Berliner Akad. (1892) 729-758.
- Larmor, J.* Proc. Phil. Soc. Cambridge 9 (1896) 108-110; Beibl. (1897) 628.
- Le Blanc, M.* Ztsch. f. physikal. Chem. 4 (1889) 553; Jahresb (1889). 315.

- Le Blanc, M. (Cont'd).* Ztsch. f. physikal. Chem. 10 (1892) 433-449; Beibl. (1893) 441.
- — und *P. Rohland.* Ztsch. f. physikal. Chem. 19 (1896) 261-286.
- Leduc, A.* J. de phys. (3) 4 (1895) 106-109.
- Lemeray, E. M.* J. de phys. 5 (1896) 272.
- Lepinay, J. Mace de.* J. de phys. 6 (1887) 190-201; Beibl. (1887) 786.
- — —. J. de phys. (3) 1 (1892) 23-31.
- Leroy, C. J. A.* Soc. franç de phys. (1888) 259-264; Beibl. (1891) 112.
- Liebisch, Th.* Gott. Nachr. (1888) 197-201.
- Littlewood, T. H.* Phil. Mag. (5) 37 (1894) 467-470.
- Liveing, G. D., and J. Dewar.* Phil. Mag. (5) 34 (1892) 205-209; Beibl. (1893) 121.
- — —. Phil. Mag. (5) 36 (1893) 328-331; Beibl. (1894) 334.
- — —. Phil. Mag. (5) 39 (1895) 268-272; Beibl. (1896) 193.
- Loewenherz, R.* Ber. chem. Ges. 23 (1890) 2180.
- Loewy.* C.-R. 122 (1896) 1157-1159.
- Lommel, E.* Sitzb. Muenchener Akad. (1888) 325-336; Ann. Phys. n. F. 36 (1889) 733-743.
- Lorentz, H. A.* Ann. Phys. n. F. 46 (1892) 244.
- — —. Zitt. Akad. Amsterdam (1895-1896) 305-311; Beibl. (1897) 29.
- Lugol, P.* Beibl. (1897) 861.
- Lumière, A. et L.* C.-R. 124 (1897) 1438-1440; Beibl. (1897) 965.
- Mach, E.* Wiener Anzeiger (1891) 223-224.
- — —. Ztsch. phys. u. chem. Unterr. 5 (1892) 225-229; Beibl. (1893) 653.
- — —. Sitzb. Wiener Akad. 101 II (1892) 5-10; 102 IIa (1893) 1035-1056.
- Madan, H. G.* Phil. Mag. (5) 21 (1886) 245; Jahresb. (1886) 289.
- — —. J. Mikroskop. (1898) 273-281; Beibl. (1898) 769.
- Maier, M.* Ann. Phys. n. F. 68 (1899) 903-916.
- Matthiessen, E.* Diss., Rostock, 1898; Beibl. (1898) 557.
- Mayberry, F., and E. J. Hudson.* Amer. Chem. J. 19 (1897) 482-484.
- Mazzotto, D.* Nuov. Cim. 5 (1897) 55-57.
- Meslin, G.* Ann. chim. phys. (6) 2 (1894) 362-408; Beibl. (1895) 500.
- Meyer, G.* Ann. Phys. n. F. 31 (1887) 321.
- Mohler, J. F.* Phys. Rev. 4 (1896) 153-154.
- Mueller, G.* Pub. astrophys. Observ. Potsdam 4 (1885) 151-216; Beibl. (1886) 279.
- Muynck, R. de.* Ann. Phys. n. F. 53 (1894) 559-563.

- Nagaoka, H.* J. Coll. Sci. Japan 4 II (1891) 301-322; Beibl. (1892) 29.
- —. J. Coll. Sci. Japan 9 I (1895) 1-13; Beibl. (1896) 652.
- Nasini, R.* Gazz. chim. Ital. 17 (1887) 48, 55; (1890) 1; (1893) 347-354; (1894) 157-170, 256-291; Jahresb. (1886) 294; (1887) 337; (1890) 291, 389; Beibl. (1893) 1111, 739; (1894) 665, 834.
- Nichols, E. L.* Phys. Rev. 2 (1895) 269.
- Offret, A.* Bull. Soc. min. de France 13 (1890) 405-668; Beibl. (1891) 565.
- Oppolzer, E. von.* Astron. Nachr. 135 (1894) 159-162; Beibl. (1894) 763.
- —. Viertelj. astron. Ges. 30 (1895) 24-39.
- Pagliani, S.* Gazz. chim. Ital. (1893) 537-553; Beibl. (1894) 335.
- Perkin, W. H.* Chem. News 63 (1891) 18-21.
- — —. J. Chem. Soc. 61-62 (1892) 287-310; Beibl. (1893) 559.
- — —. J. Chem. Soc. 67-68 (1895) 1-7, Chem. News 72 (1895) 288.
- Perreau, F.* Ann. chim. phys. (7) 7 (1896) 289-348; Beibl. (1896) 192.
- Perrot, F. L.* Arch. de Genève 25 (1891) 26-70; Beibl. (1891) 357.
- Pflueger, A.* Ann. Phys. n. F. 58 (1896) 493-499.
- Pizzetti, P.* Atti Accad. Torino 33 (1898) 213-226.
- Pope, W. J.* J. Chem. Soc. 69 (1896) 1530-1536.
- Poynting, J. H.* Proc. Birmingham Phil. Soc. 7 (1890) 210-219; Beibl. (1891) 562.
- Pulfrich, C.* Ann. Phys. n. F. 30 (1887) 317-320; 34 (1888) 326; Ztsch. phys. Chem. 4 (1889) 312; 18 (1895) 294-300; Ann. Phys. n. F. 59 (1896) 671.
- Quesneville, G.* C.-R. 121 (1895) 1136-1139, 522-525.
- Radau* Bull. astron. 1 (1884) 1.
- Ramsay, W., and M. W. Travers.* Rept. Brit. Assoc. (1897) 587-588.
- —. Proc. Roy. Soc. 62 (1898) 225-232; Beibl. (1898) 217.
- Rayleigh, Lord.* Rept. Brit. Assoc. (1895) 609; Beibl. (1896) 192.
- Ricco, A.* Rend. Accad. Roma 6 (1890) 13-17.
- Richardson, A.* Phil. Mag. (5) 32 (1891) 277-284; Beibl. (1892) 537.
- Righi, A.* Atti Accad. Roma 4 (1895) 203-207; Nuov. Cim. (41) (1895) 261-263.
- Rosenberg, W.* J. russ. phys. chem. Ges. 19 (1887) 477-480; Beibl. (1888) 472.
- Rubens, H., und B. W. Snow.* Ann. Phys. n. F. 146 (1892) 529.
- Rucker, A. W.* Phil. Mag. (5) 28 (1889) 271.

- Ruoss, H.* Ann. Phys. n. F. 48 (1893) 531.
- Scheiner, J., und S. Hirayama.* Sitzb. Berliner Akad. (1894) 433-442.
- Schmidt, A.* Beibl. (1892) 152.
- . Beibl. (1895) 890.
- Schott, G. A.* Proc. Roy. Soc. 54 (1894) 26-30; Phil. Trans. 185 (1895) 823-887.
- Schrauf, A.* Wiener Anzeiger (1890) 105-106.
- Schumann, R.* Astron. Nachr. 141 (1896) 81-83.
- , V. Beibl. (1890) 1095; (1896) 648, 975; (1897) 839, 973; (1898) 841.
- Schuster, A.* Phil. Mag. (5) 35 (1891) 77-86; Beibl. (1891) 561.
- Schutt, F.* Ztsch. phys. Chem. 5 (1890) 349; Jahresb. (1888) 387.
- . Ztsch. physikal. Chem. 9 (1892) 349-377; Beibl. (1896) 735.
- Seeliger, H.* Sitzb. Muenchener Akad. 21 (1891) 239-246; Beibl. (1894) 78.
- Sella, A.* Rend. Accad. Roma 7 (1891) 300-308; Beibl. (1892) 423.
- Shdanko, A.* Soc. astron. Russe 1 (1896) 33-42.
- Shea, D.* Ann. Phys. n. F. 47 (1892) 177.
- Sieben, G.* Ann. Phys. n. F. 23 (1884) 312.
- Silow, P.* Ztsch. phys. u. chem. Unterr. 9 (1896) 280-281; Beibl. (1897) 223.
- Simon, E.* Sitzb. Wiener Akad. 104 II (1895) 565-593.
- Sluginoff, N.* J. russ. phys. chem. Ges. 23 (1891) 427-430.
- Soret, Ch., A. Borel, et E. Dumont.* Arch. de Genève (3) 3 (1897) 376-382; Beibl. (1897) 731.
- J. et E. Sarasin. C.-R. 108 (1889) 1248.
- StaigmueUer, H.* Beibl. (1896) 528; (1897) 28.
- Starke, H.* Verh. deutsch. physikal. Ges. 1 (1899) 117-122.
- Steinheil, R.* Gekroente Preisschrift, Diss., Muenchen, 1889; Beibl. (1891) 558.
- Stoeber, F.* Bull. Acad. Belg. (3) 30 (1895) 520-539.
- Straubel, R.* Diss., Jena, 1888; Beibl. (1890) 519; Ann. Phys. n. F. 56 (1895) 746-761.
- StrehI, K.* Beibl. (1897) 419; (1898) 101.
- Stscheglayew, J.* Ann. Phys. n. F. 64 (1898) 325-332; 65 (1898) 745.
- Sundvik, E. E.* Oefvers. Finska Vet. Forh. 39 (1897) 1-11.
- Sutherland, W.* Phil. Mag. (5) 27 (1889) 141.
- Swartz, Fred.* Bull. Acad. Belg. 34 (1897) 293-307; Beibl. (1898) 150.
- Tammann, G.* Ztsch. f. physikal. Chem. 21 (1896) 537-544; Beibl. (1897) 969.

- Tolomei, G.* Riv. Sci. industr. 25 (1893) 71-72.
- Trapesanzjanz, Ch.* Ber. chem. Ges. 26 (1893) 1428-1433; Beibl. (1894) 335.
- Traube, J.* Ber. chem. Ges. 29 (1896) 2731-2742; Beibl. (1897) 509.
- —. Ber. chem. Ges. 30 (1897) 38-47; Beibl. (1897) 510.
- Turner, H. H.* Mon. Not. 57 (1897) 133-140.
- Verschaffelt, J.* Bull. Acad. Belg. (1894) 49-84; Beibl. (1894) 833.
- Viola.* Atti Accad. Roma 5 (1896) 212-216.
- Voigt, W.* Ann. Phys. n. F. 35 (1888) 76-100.
- —. Götting. Nachr. (1898) 6 pp.
- Wadsworth, F. L. O.* Phys. Rev. 4 (1897) 480-497; Beibl. (1898) 623.
- Wallach, O.* Götting. Nachr. (1896) 69-73; Beibl. (1897) 732.
- Wallerant, F.* Bull. Soc. min. de France 20 (1897) 172-173; Beibl. (1898) 156.
- Walter, A.* Leipzig: Teubner, 1898, 74 pp.
- —. B. Ann. Phys. n. F. 38 (1889) 107-118; C.-R. 110 (1890) 708-709.
- —. Ann. Phys. n. F. 57 (1896) 394-396.
- Wasastjerna, L.* Oefvers. Finska Vet. Forh. 31 (1888) 167-177; Beibl. (1891) 111.
- Wehner, F. H.* Beibl. (1891) 210.
- Weiss, G.* J. de phys. 6 (1897) 688-690; Beibl. (1898) 557.
- Wellmann, V.* Beobacht. Sternwarte, Potsdam (1892) 75-79.
- Wiedemann, E., und G. C. Schmidt.* Jahrb. f. Photogr. u. Reprod. (1896) 15.
- Wien, W.* Ann. Phys. n. F. 28 (1886) 117; Jahresb. (1886) 300.
- Wilsing, J.* Ztsch. f. Math. u. Phys. 40 (1895) 353-362; Beibl. (1896) 250.
- Wind, C. H.* Versl. Akad. Amsterdam 6 (1897) 79-84; Beibl. (1899) 327.
- Wulff, L.* Ztsch. f. Instrum. 17 (1897) 292-298; Beibl. (198) 104.
- Zecchini, F.* Rend. Accad. Roma (5) 1 (1892) 180-188; Beibl. (1893) 115.
- —. Rend. Accad. Roma (5) 2 (1893) 491-494; Beibl. (1893) 1048.
- —. Gazz. chim. Ital. 27 (1897) 358-384; Beibl. (1897) 732.
- Zeeman, P.* Zitt. Akad. Amsterdam (1895-1896) 116-119; Beibl. (1896) 528.
- Zimanyi, K.* Ber. aus Ungarn 11 (1893) 189-232.
- Zoppelari.* Rend. Accad. Roma 3 (1894) 330-339; Beibl. (1895) 487.



## BIBLIOGRAPHY OF SCIENCE.

Elster, J. M., and E. Hultsch. *Beiträge z. Vertheil. d. Wärme*. Abh. 1891, 12 pp.

Frank, H. *Arch. Pharm. Med. (Lipp.)* 25: 1891, 113-115; 117-119; 121-123; 125-127; 129-131.

Wilkinson, E. J. *Asiaticus*. J. 7 (1891) 103.

## BIBLIOGRAPHY.

Humphreys, W. J. *Asiaticus*. J. 6 (1891) 109-111.

Kraus, G., and Hultsch, E. *Ber. chem. Ges.* 24 (1891) 1094-1100; Beibl. (1891) 21.

Rosenthal and Tarnik. *Asiaticus*. J. 3 (1891) 106-108.

## BIBLIOGRAPHY.

Cook, F. A., and Plummer, J. J. *Am. J. Sci.* (3) 41 (1891) 392-400.

Humphreys, W. J. *Asiaticus*. J. 6 (1891) 109-111.

## BIBLIOGRAPHY.

Kraus, F. *Ann. Phys. u. P.* 67 (1891) 106-108.

Stark, J. *Ann. Phys. u. P.* 62 (1891) 103-105.

## BIBLIOGRAPHY.

Humphreys, W. J. *Asiaticus*. J. 6 (1891) 109-111.

Rosenthal and Tarnik. *Asiaticus*. J. 3 (1891) 106-108.

## BIBLIOGRAPHY.

Hassberg, B. *Swedish Vet. Akad. Handl.* 23 I (1891) 8 pp.; Beibl. (1891) 35.

## BIBLIOGRAPHY.

Abney, W. de W. and G. S. Eissner. *Proc. Roy. Soc.* 47 (1890) 249.

Donner, E. *C.-R.* 110 (1890) 40-42, 139-141; *Jahresh.* (1890) 386, 387.

Elster, J., and H. Geitel. *Ann. Phys. u. P.* 62 (1891) 599-602.

Étard, A. *C.-R.* 113 (1891) 699-701.

Ewan, T. *Phil. Mag.* 13 (1891) 317-342; Beibl. (1891) 37.

Forster, F. *Ber. chem. Ges.* 25 (1891) 2494-2518.

Gramont, A. de. *C.-R.* 126 (1898) 1155-1157, 1234, 1513-1515; Beibl. (1898) 774.

- Harcourt, Sir A. V., and F. W. Humphrey.* Rept. Brit. Assoc. (1891) 609.
- Hartley, W. N.* Chem. News 66 (1892) 311-314; Beibl. (1893) 925.
- Kastle, J. H.* Amer. Chem. J. 16 (1894) 326-340; Beibl. (1894) 912.
- Living, G. D.* Proc. Phil. Soc. Cambridge 10 (1899) 40-44.
- MacGregor, J. G.* Trans. Roy. Soc. Canada III (1891) 27-41; Beibl. (1893) 123.
- Meyer, Lothar.* Ztsch. phys. Chem. (3) 11 (1893) 426-428.
- Spring, W.* Bull. Acad. Belg. 31 (1896) 640-654; Beibl. (1896) 776.
- Walter, B.* Ann. Phys. n. F. 38 (1889) 107-118; C.-R. 110 (1890) 708-709.
- Wiegand, A.* Ztsch. f. phys. Chem. 11 (1893) 227-247; Beibl. (1893) 506.

## SAMARIUM.

- Boisbaudran, F. Lecoq de.* C.-R. 114 (1892) 575-577; Beibl. (1892) 740.
- . C.-R. 117 (1893) 199-201.
- Demarcay, E.* C.-R. 102 (1886) 1551; 105 (1887) 276-277; Beibl. (1887) 708; 122 (1896) 728-730.
- Forstling, S.* Svensk. Vet. Handl. 18 1 (1893) 23 pp.; Beibl. (1894) 562.

## SAMARSKITE.

- Crookes, W.* C.-R. 102 (1886) 1464-1466; Jahresb. (1886) 403.
- Demarcay, E.* C.-R. 104 (1887) 580.

## SCANDIUM

- Humphreys, W. J.* Astrophys. J. 6 (1897) 169-232.
- Thalen, Rob.* Oefvers. Akad. Stockholm (1881); Beibl. (1887) 249.

## SECONDARY SPECTRUM.

- Boulouch, R.* J. de phys. 3 (1894) 28-31; Beibl. (1894) 571.
- Czapski, S.* Ztsch. f. Instrum. 9 (1889) 250-252.
- Kerber, A.* Beibl. (1894) 336.

## SELENIUM.

- Gramont, A. de.* C.-R. 120 (1895) 778-781; Beibl. (1895) 566.
- . C.-R. 127 (1898) 866-868.
- Majorana, Q.* Atti Accad. Roma 5 (1896) 45-52.

- Mohr, W. *Zurich Z. Kristallogr.* 17 (1889) 336-338.  
 Ruge, T., and P. Ruge, F. *Ann. Phys. u. E.* 61 (1897) 641-686.  
 Schuster, A. *Nature* 57 (1897) 320-321; Beibl. (1898) 402.  
 Zappalà, J. *Gazz. chim. Ital.* 2 (1894) 396-401; Beibl. (1895) 487.

## SPECTRA OF THE SPECTRAL LINES

- Fitzgerald, F. F. *Astronomy* 17 (1897) 210-211.  
 Linder, J. M. *Nature* 57 (1897) 417-418.

## SILICON.

- Loew, E. *Gazz. chim. Ital.* 17 (1897) 437-438; Beibl. (1898) 397.  
 237.  
 Loew, J. M., and E. Loew, E. *Denkschr. Wiener Akad.* 60 (1893) 241-252.  
 ———, ———. *Sitzb. Wiener Akad.* 107 (1894) 41-43.  
 Ruge, T., and F. Ruge, F. *Astronomy* 17 (1897) 210-211.

## SILVER.

- Brecher, F. *Zurich Z. Kristallogr.* 17 (1889) 1238-1290, 1419-1421.  
 Loew, J. M., and E. Loew, E. *Beibl.* 1896 306.  
 ———, ———. *Sitzb. Wiener Akad.* 107 (1894) 41-43.  
 Ruge, T., and F. Ruge, F. *Ann. Phys. u. E.* 61 (1897) 212-214.  
 Ruge, T., and F. Ruge, F. *Astronomy* 17 (1897) 210-211.  
 Ruge, T., and F. Ruge, F. *Ann. Phys. u. E.* 61 (1897) 212-214.  
 Loew, J. M., and E. Loew, E. *Denkschr. Wiener Akad.* 60 (1893) 241-252.  
 Schuster, A. *Beibl.* 1893 103.

## SILVER.

- Brecher, F. *C.-R.* 127 (1898) 300-301; 128 (1899) 146-151.  
 Ruge, T. *Ann. Phys. u. E.* 61 (1897) 39.  
 Ruge, T. *Druck Trans.* 1 (1892) 181-182.  
 Loew, J. M. *C.-R.* 125 (1897) 305-307; Beibl. (1898) 352.  
 Ruge, T. *Ann. Phys. u. E.* 61 (1897) 153-162.  
 Loew, J. M. *C.-R.* 123 (1897) 291-292; Beibl. (1892) 26.  
 ———, ———. *Arch. de Geneve* 27 (1892) 330-405; 321-335; Beibl. (1896) 23.  
 Loew, J. M., and E. Loew, E. *Denkschr. d. Wiener Akad.* 60 (1893) 467-476.  
 ———, ———. *Denkschr. d. Wiener Akad.* 61 (1894) 347-364.

- Giesel, F. Ber. chem. Ges. 30 (1897) 156-158; Beibl. (1897) 337.  
 Glöser, M. Ztschr. phys. chem. Unterr. 6 (1893) 303.  
 Gramont, A. de. C.-R. 122 (1896) 1411-1413.  
 Gumlich, E. Ztsch. f. Instr. 16 (1896) 97-115.  
 Humphreys, W. J. Astrophys. J. 6 (1897) 169-232.  
 Julius, V. A. Natuurk. Verh. Amsterdam (1888) 11 pp; Beibl. (1889) 496.  
 Kelvin, Lord. Proc. Roy. Soc. Edinb. 22 (1899) 523-532.  
 Kral, H. Chem. Ztng. (1892) 49; Beibl. (1893) 747.  
 Merkelbach, W. Ztsch. f. phys. u. chem. Unterr. 5 (1892) 253.  
 Michelson, A. A., and E. W. Morley. Phil. Mag. (5) 24 (1887) 463-466.  
 Muller, F. C. G. Ztsch. phys. chem. Unterr. 8 (1895) 95-96.  
 Paschen, F. Ann. Phys. n. F. 53 (1894) 337-342.  
 Rayleigh, Lord. Chem. News 62 (1890) 1-4, 17-19.  
 Rubens, H., und Snow, B. W. Ann. Phys. n. F. 46 (1892) 529.  
 ———. Verh. d. phys. Ges. Berlin 15 (1896) 108-110. Beibl. (1897) 130.  
 ——— und E. Ahinass. Ann. Phys. n. F. 65 (1898) 241-256.  
 ———. Verh. d. phys. Ges. Berlin 17 (1898) 42-45.  
 ——— und A. Trowbridge. Ann. Phys. n. F. 60 (1897) 724-739.  
 St. Dunstan, A., M. E. Rice, and C. A. Kraus. Amer. J. Sci. (4) 3 (1897) 472-475.  
 Salet, G. C.-R. 110 (1890) 282-283; Beibl. (1890) 511.  
 Salkowski, E. Ztsch. f. physiol. Chem. 12 (1888) 227; Jahresb. (1888) 2413.  
 Schutt, F. Ztsch. physikal. Chem. 5 (1890) 349.  
 Siertsema, L. H. Archiv. néerland. 2 (1899) 291-380; Beibl. (1899) 384-385.  
 Smith, A. P. Chem. News 61 (1890) 292-293; Jahresb. (1890) 384.  
 Snow, B. W. Phys. Rev. 1 (1893) 290; Beibl. (1894) 997.  
 Stoney, J. G. Proc. Roy. Soc. Dublin, n. s. 7 (1892) 204-218; Beibl. (1893) 201.  
 Svejcar, V. Böhm. math. phys. Ztsch. 21 (1892) 238.  
 Tumlirz, O. Repert. d. Phys. 23 (1887) 404-405.  
 Vogel, H. W. Beibl. (1895) 422; Photogr. Mittheil. 31 (1895) 367-369.  
 Voigt, W. Göttinger Nachr. (1898) 6 pp.  
 Wiedemann, E., und G. C. Schmidt. Ann. Phys. n. F. 57 (1896) 447-453.  
 ———. Verh. d. physikal. Ges. Berlin 16 (1897) 37-40.

- Zecchini, F.* Rend. Accad. Roma (5) 1 (1892) 180-188; Beibl. (1893) 115.  
*Zimanyi, K.* Ber. aus Ungarn. 11 (1893) 189-232.

## SOLUTIONS.

- Bayrac et Camichel.* C.-R. 122 (1896) 193-195; Beibl. (1897) 742.  
*Borgesius, A. H.* Ann. Phys. n. F. 54 (1895) 221-243.  
*Conroy, Sir John.* Proc. Roy. Soc. 64 (1899) 308-318.  
*Dennis, L. M.* J. Amer. Chem. Soc. 20 (1898) 1.  
*Dijken, D.* Beibl. (1897) 333, 970.  
*Donnan, F. G.* Ztsch. f. physikal. Chem. 19 (1896) 465-488.  
 — — —. Nature 54 (1896) 55; Beibl. (1896) 777.  
*Doumer, E.* C.-R. 110 (1890) 139-141.  
*Étard, A.* C.-R. 113 (1891) 699-701.  
*Ewan, T.* Phil. Mag. (5) 33 (1892) 317-342.  
 — — —. Proc. Roy. Soc. 56 (1894) 286-288; Beibl. (1894) 998.  
 — — —. Proc. Roy. Soc. 59 (1895) 117-161; Beibl. (1895) 888.  
*Fievez, Ch., et E. van Aubel.* Bull. Acad. Belg. (3) 17 (1889) 102-104.  
*Förster, F.* Ber. chem. Ges. 25 (1892) 2494-2518.  
*Gladstone, J. H.* J. Chem. Soc. 59 (1891) 589-598.  
 — — — and *W. Hibbert.* J. Chem. Soc. 67-68 (1895) 831-868;  
 71 (1897) 822-833; Beibl. (1896) 195; (1897) 966.  
*Hallwachs, W.* Göttinger Nachr. (1892) 302-309.  
 — — —. Ann. Phys. n. F. 53 (1894) 1; 68 (1899) 1-45.  
*Hamburger, F.* Ann. Phys. n. F. 56 (1895) 173-174.  
*Harcourt, Sir A. V., and F. W. Humphrey.* Rept. Brit. Assoc. (1891) 609.  
*Isaachsen, D.* Ztsch. physikal. Chem. 8 (1891) 145-149.  
*Kastle, J. H.* Amer. Chem. J. 16 (1894) 326-340; Beibl. (1894) 912.  
*Katz, G. J.* Diss., Erlangen, 1898; Beibl. (1898) 774.  
*Knoblauch, O.* Ann. Phys. n. F. 54 (1895) 193-220.  
*Kruess, G., und Thiele, E.* Ztsch. anorg. Chem. 7 (1894) 52-81.  
*Lea, M. Carey.* Phil. Mag. (5) 36 (1893) 88-98.  
*Lemoine, G.* C.-R. 112 (1891) 1124-1127.  
*Liveing, G. D.* Cambridge Phil. Trans. 15 I (1890) 19 pp.  
 — — —. Cambridge Phil. Proc. 10 (1899) 40-44; Beibl. (1899) 782.  
*MacGregor, J. G.* Trans. Roy. Soc. Canada, III (1891) 27-41; Beibl. (1893) 123.  
*Magnanini, G.* Rend. Accad. Roma 7 (1891) 104-112.  
 — — — e *T. Benticoglio.* Rend. Accad. Roma (5) 2 (1893) 17-23.

- Monti, V. *Nuov. Cim.* (4) 3 (1896) 212-216.  
 Muynck, R. de. *Ann. Phys. n. F.* 53 (1894) 559-563.  
 Nasini, R. *Gazz. chim. Ital.* 22 (1890) 190-220.  
 Nichols, E. L., and M. C. Spencer. *Phys. Rev.* 2 (1895) 344-360; Beibl. (1895) 493.  
 Pickering, S. W. *Ber. chem. Ges.* 25 (1892) 1099-1108, 1314-1324, 1854-1866, 2012-2017, 2518-2524.  
 Pitcher, F. B. *Amer. J. Sci.* (3) 36 (1888) 332-336; Beibl. (1889) 218.  
 Pulfrich, C. *Ztsch. physikal. Chem.* 4 (1889) 561; *Jahresh.* (1889) 312.  
 Rigollot, H. *C.-R.* 112 (1891) 38-40; Beibl. (1891) 280.  
 Sabatier, P. *C.-R.* 118 (1894) 1042-1043, 1144-1146.  
 Schutt, F. *Ztsch. f. physikal. Chem.* 9 (1892) 349-377; Beibl. (1892) 735.  
 Soret, Ch., Arn. Borel, et E. Dumont. *Arch. de Genève* (3) 3 (1897) 376-382.  
 Spring, W. *Rec. des Trav. chim. des Pays Bas* 18 (1899) 233-247; Beibl. (1899) 633.  
 Stock, A. *Sitzb. Soc. phys. med. Erlangen*, Feb. 13, 1893; Beibl. (1893) 1059.  
 Stortenbeker, W. *Versl. Akad. Amsterdam* (1892) 160-163; Beibl. (1894) 758.  
 Stscheglayew, J. *J. de phys.* (3) 4 (1895) 546-551.  
 ——. *J. russ. phys. Ges.* 28 (1896) 41-55; Beibl. (1897) 409.  
 Tammann, G. *Ztsch. physikal. Chem.* 21 (1896) 537-544.  
 Walter, B. *Ann. Phys. n. F.* 38 (1889) 107-118; 36 (1889) 518-532.  
 ——. *C.-R.* 110 (1890) 708-709. See Doumer, Do. 957.  
 ——. *Ann. Phys. n. F.* 45 (1892) 189.  
 Wiedermann, E. *Ann. Phys. n. F.* 46 (1892) 160.  
 ——. *Ztsch. f. physikal. Chem.* 18 (1895) 529-553.  
 Zsigmondy, R. *Ann. Phys. n. F.* 49 (1893) 531.

## SPECTRO-PHOTOMETRY.

- Aymonnet. *C.-R.* 117 (1893) 304-306, 402-405; 123 (1896) 645-648; Beibl. (1893) 1057-1058.  
 Béliopolsky, A. *Mem. Spettr. Ital.* 28 (1899) 103-108.  
 Blondel, A. *J. de phys.* 6 (1897) 187.  
 Brennand, W. *Proc. Roy. Soc.* 49 (1891) 255-280.  
 Broca, A. *J. de phys.* 3 (1893) 206-213; *Soc. franç. de phys.* (1894) 81-93; *Rev. des Sci.* 8 (1897) 935-939; Beibl. (1898) 350.  
 Bruehl, J. W. *Ber. chem. Ges.* 30 (1897) 158-162.

- Buisson, H.* C.-R. 127 (1898) 224-227; Beibl. (1898) 803.  
*Charlier, C. V. L.* Beibl. (1894) 99; (1899) 950-951.  
*Chwolson, O.* Bull. Acad. St. Petersb. 31 (1886) 213-261; Beibl. (1887) 149.  
*Cornu, A.* Ann. Bureau des Longit. D. 1 (1891) 1; Beibl. (1891) 276.  
 ——. J. de phys. (3) 2 (1893) 385-393, 441-449.  
*Crew, H.* Astrophys. J. 7 (1898) 298-304.  
*Crova, A.* Ann. chim. phys. (5) 14 (1888) 541-574.  
 ——. C.-R. 122 (1896) 654-656; 123 (1896) 928-932.  
*Deslandres, H.* Bull. astron. de France 1 (1895) 368-373; Beibl. (1897) 343.  
 ——. Astrophys. J. 9 (1899) 167-172.  
*Doubt, T. E.* Phil. Mag. (5) 46 (1898) 216-223.  
*Ebert, H.* Verh. deutsch. Naturf. u. Aerzte (1887) 82.  
*Elster, J., und H. Geitel.* Ann. Phys. n. F. 48 (1893) 625.  
*Exner, F.* Repert. d. Phys. 22 (1886) 605-615; Beibl. (1887) 146.  
*Fabry, C., et A. Perot.* C.-R. 123 (1896) 802-805.  
 ——. Ann. chim. phys. (7) 12 (1897) 459-501; Beibl. (1898) 565-567.  
 ——. C.-R. 128 (1899) 1156-1158; Beibl. (1899) 635.  
 ——. J. M. de Lépinay, et A. Perot. C.-R. 128 (1899) 1317-1320.  
*Fargis, G. A.* Georgetown Observ., D. C., 1894, 28 pp.  
*Ferrel, W.* Amer. J. Sci. (3) 41 (1891) 378-386; Beibl. (1891) 645.  
*Ferry, E. S.* Phys. Rev. 1 (1894) 338-346; Beibl. (1894) 747.  
 ——. Phys. Rev. 7 (1898) 296-306; Beibl. (1899) 251.  
*Fery, C.* C.-R. 119 (1894) 402-404; Beibl. (1895) 168.  
*Filon, L. N. G.* Phil. Mag. (5) 47 (1899) 441-461; Beibl. (1899) 559.  
*Finsterwalder, S.* Jahresb. d. deutsch. Math. Ver. 6 (1899) 1-42.  
*Fresnaye, H. de la.* C.-R. 115 (1892) 1289-1292; Beibl. (1893) 916.  
*Frost, E. B.* Astrophys. J. 2 (1895) 235-236; Beibl. (1896) 371.  
 ——. Astrophys. J. 10 (1899) 207.  
*Geitel, W.* Verh. deutsch. Naturf. u. Aerzte (1890) 50.  
*Gortz, A.* Diss., Tübingen, 1892; Beibl. (1893) 378.  
*Gouy.* Ann. chim. phys. (6) 16 (1889) 262-289; C.-R. (1893) 626-628; Beibl. (1894) 570.  
*Grosse, W.* Ztsch. f. Instrum. 13 (1893) 6-13.  
*Guilleaume, C. E.* Arch. de Genève 28 (1892) 302-306; Ztsch. f. Instrum. 13 (1893) 155-157.  
*Hartman, L. W.* Phys. Rev. 9 (1899) 176-189.  
*Hartmann, J.* Sitzb. Wiener. Akad. (1898) 742-756.  
 ——. Astrophys. J. 10 (1899) 225-240.



- Hasselberg, B.* Bull. Acad. St. Petersb. 6 (1888) 670-699.  
*Haycraft, J. B.* Proc. Roy. Soc. 61 (1897) 49-50.  
*v. Heffner-Altnack.* Beibl. (1897) 734.  
*Henry, Ch. C. R.* 116 (1893) 96-98; 122 (1896) 951-954, 1198-1200.  
*Herschius, N. A.* J. de phys. (3) 2 (1893) 504-505.  
*Hoefler, F.* Verh. deutsch. Naturf. u. Aerzte (1897) 37-38, 727.  
*Holetschek, J.* Vierteljahrsschr. d. astron. Ges. 31 (1897) 250, 261-265.  
*Homann, H.* Diss., Berlin, 1885; Beibl. (1887) 146.  
*Huchner, G.* Ztsch. physikal. Chem. 3 (1889) 562; Archiv f. Physiol. (1890) 1, 28-30.  
*Jaumann, G.* Sitzb. Wiener Akad. 100 (1891) 1239-1243.  
*Jewell, L. E.* Astron. and Astrophys. 12 (1893) 815-821; Beibl. (1894) 670.  
*Joubin, P.* C.-R. 115 (1892) 1061-1063; Beibl. (1893) 1071.  
*Keeler, J. E.* Rept. Brit. Assoc. (1896) 729-731.  
*Ketteler, E., und C. Pulfrich.* Ann. Phys. n. F. 15 (1882) 337.  
*König, A.* Ann. Phys. n. F. 45 (1892) 604; Ztsch. f. Psychol. u. Physiol. (1893) 422-424.  
 ——. Sitzb. Berliner Akad. 39 (1896) 945-949; Beibl. (1897) 423.  
*Kronc, H.* Ann. Phys. n. F. 46 (1892) 426; Photogr. Mitth. (1893) 133-135, 148-150.  
*Kruss, G.* Ann. Phys. n. F. 11 (1887) 581.  
 ——. u. H. Hamburg, 1891.  
 ——. H. Beibl. (1898) 218.  
*Lagrange, E., et P. Stroobant.* Bull. Acad. Belg. (3) 23 (1892) 811-827.  
*Lambling, E.* Bull. Soc. chim. Paris (3) 2 (1889) 774; Jahresb. (1889) 255.  
*Langley, S. P., and F. W. Very.* Amer. J. Sci. (3) 39 (1890) 97-113.  
 ——. Amer. J. Sci. (4) 5 (1898) 241-245; Beibl. (1898) 399.  
*Lehmann-Filhes, R.* Astron. Nachr. 136 (1894) 17-30; Beibl. (1894) 917.  
*Lépinay, J. Macé de.* Ann. chim. phys. (6) 10 (1887) 68-85; Beibl. (1887) 442.  
 ——. Ann. chim. phys. (7) 5 (1895) 210-256.  
*Liebethal, E.* Beibl. (1888) 525.  
*Lindemann, E.* Astron. Nachr. 137 (1894) 10; 139 (1896) 345-347.  
*Lodge, O. J.* Rept. Brit. Assoc. (1891) 560; Electrician (1896) 783-785.

- Lommel, E.* Sitzb. Muenchener Akad. (1887) 95-132; Ann. Phys. n. F. 36 (1889) 473-502.
- Lummer, O.* Der Mechaniker 4 (1896) 193-196, 225-228; Beibl. (1896) 974.
- — und *E. Brodhun.* Ztsch. f. Instrum. (1889) 41-50, 461-465; 10 (1890) 119-133; 12 (1892) 41-50, 133-140; 16 (1896) 299-307.
- Mascart.* C.-R. 113 (1891) 571-573; Beibl. (1893) 28.
- —. Ann. chim. phys. (6) 24 (1891) 373-394.
- Maunder, E. W.* Observ. 19 (1896) 84-86; Astrophys. J. 3 (1896) 311-313.
- Mayer, A. M.* Amer. J. Sci. (3) 31 (1893) 1-22; Phil. Mag. (5) 36 (1893) 153-175.
- Mengarini, G.* Atti. Accad. Roma 3 (1887) 482-489, 566-573; Beibl. (1888) 663; (1890) 376.
- Messerschmitt, J. B.* Beibl. (1891) 108.
- Meyer, L.* Ztsch. f. physikal. Chem. (3) 11 (1893) 426-428.
- Michelson, A. A., and E. Morley.* Amer. J. Sci. (3) 34 (1887) 427-430; 37 (1889) 181-186.
- — —. Phil. Mag. (5) 31 (1891) 280-346; 34 (1892) 280-299.
- — —. C.-R. 116 (1893) 790-794; Beibl. (1894) 625.
- — —. J. de phys. (3) 3 (1894) 5-22.
- — —. Amer. J. Sci. (4) 3 (1897) 475-479.
- Müller, G.* Pub. astrophys. Obs. Potsdam (1891) 1-101; Beibl. (1893) 1063.
- —. Naturwiss. Rundsch. 8 (1893) 458-460.
- —. Leipzig: Engelmann, 1897, 556 pp.
- Murphy, D. W.* Astrophys. J. 6 (1897) 1-21; Beibl. (1898) 663.
- Newall, H. F.* Mon. Not. 57 (1897) 567-577.
- Nichols, E. F.* Sitzb. Berliner Akad. (1896) 1183-1196; Ann. Phys. n. F. 60 (1897) 401-417.
- — —. Phys. Rev. 4 (1897) 297-313.
- —, *E. L., and W. Franklin.* Amer. J. Sci. (3) 38 (1890) 100-114; Beibl. (1890) 39.
- Orbinsky, A. A.* Astron. Nachr. 138 (1895) 9-12; Beibl. (1896) 202.
- Paschen, H., und H. Wanner.* Sitzb. Preuss. Akad. (1899); Astrophys. J. 9 (1899) 300-307.
- Pickering, E. C.* Annals Harv. Coll. Obs. (1889) 119-214; Beibl. (1889) 816.
- — — and *O. C. Wendell.* Annals Harv. (1890) Obs. 23 and 24
- — —. Astrophys. J. (1895) 154-159.

- Pickering, E. C.* Astrophys. J. 3 (1896) 281-285; Astron. Nachr. 142 (1896) 9-12.
- Plummer, W. E.* Mon. Not. (1897) 294-296.
- Poincaré, H.* C.-R. 120 (1895) 420-421; Beibl. (1896) 35.
- Pope, W. J.* Proc. Roy. Soc. 60 (1896) 7-10.
- Precht, J.* Archiv f. wissensch. Photogr. (1899) 149-151.
- Pulfrich, C.* Ztsch. f. Instrum. 13 (1893) 267 273.
- Rayleigh, Lord.* Read before the Roy. Inst. Feb. 6, 1891; Beibl. (1892) 667.
- Reinke, J.* Botan. Ztng. (1886) Nos. 9-14; Beibl. (1887) 709.
- Renz, F.* Bull. Acad. St. Petersb. 5 II (1895) 293-331.
- Richardson, A.* Phil. Mag. (5) 32 (1891) 277-284; Beibl. (1892) 537.
- Rizzo, G. B.* Mem. Spettr. Ital. 27 (1898) 10-32.
- Roberts, A. W.* Astrophys. J. 4 (1896) 265-273.
- Rood, O. N.* Amer. J. Sci. (3) 46 (1893) 173-176; Beibl. (1894) 79.
- . Amer. J. Sci. (4) 8 (1899) 258-261.
- Rubens, H.* Verh. d. physikal. Ges. Berlin 9 (1890) 27-31.
- Safarik.* Vierteljahrsschr. d. astron. Ges. (1886) 5; Beibl. (1887) 35.
- Savelief, R.* C.-R. 108 (1889) 287-289; 10 (1890) 235-237; Beibl. (1890) 786.
- . Ann. chim. phys. (7) 4 (1895) 424-429.
- Scheiner, J.* Astron. Nachr. 128 (1891) 113-122; Beibl. (1894) 103.
- . Pub. astron. Observ. Potsdam 7 II (1895) 171-335.
- Schlesinger, F.* Astrophys. J. 9 (1899) 159-161.
- Schur, W.* Mon. Not. 57 (1897) 150-151.
- Schwarzschild, K.* Astron. Nachr. 143 (1897) 1-11.
- Sczelchou.* Pflueger's Archiv fur Physiol. 41 (1888) 373.
- See, T. J. J.* Astron. Nachr. 139 (1895) 17-26; Beibl. (1896) 371.
- . Astron. Nachr. 139 (1895) 161-164; Beibl. (1897) 344.
- Seeliger, H.* Sitzb. Muenchener Akad. (1888) 201-248.
- Sharp, C. H., and W. R. Turnbull.* Phys. Rev. 2 (1894) 1-35; Beibl. (1895) 170.
- Simon, H. Th.* Ann. Phys. n. F. 59 (1896) 91-115.
- Simonoff.* Beibl. (1894) 337.
- Stokes, G. G.* Rept. Brit. Assoc. (1889) 40-41; (1892) 158-165; Beibl. (1893) 830.
- Straubel, R.* Astron. Nachr. 139 (1896) 225-239; Beibl. 334.
- Strehl, K.* Ztsch. f. Instrum. 16 (1896) 257-267; Beibl. (1897) 419.
- Teclu, N.* J. prakt. Chem. 47 (1893) 568-583; Beibl. (1893) 919.
- Thiele, E.* Ztsch. f. physikal. Chem. 16 (1895) 147-156; Beibl. (1895) 426.

- Thompson, S. P.* Phil. Mag. (5) 36 (1893) 120-128; Beibl. (1894) 557.
- Tissandier, G.* La Nature 18 (1890) 219-220; Beibl. (1890) 1094.
- Tufts, F. L.* Trans. New York Acad. Sci. 16 (1897) 190-212; Beibl. (1897) 971.
- Ulsch, K.* Chem. Centralbl. (4) 2 (1890) 569-570.
- Uppenborn, F.* Ber. electrotechn. Versuch. Muenchen (1888) 12 pp.; (1890) No. 14; Beibl. (1888) 525; (1890) 778.
- Very, F. W.* Astrophys. J. (1895) 293-305; Beibl. (1896) 699.
- Violle, J.* Soc. franç. de phys. 3 (1895) 39-40, 165; Beibl. (1896) 275.
- Vogel, H. C.* Sitzb. Berliner Akad. (1888) 397-401; Beibl. (1889) 166.
- . Astron. Nachr. 121 (1889) 241-258; Beibl. (1889) 947-949.
- . Sitzb. Berliner Akad. 28 (1891) 533-539; Beibl. (1892) 155.
- . Pub. astr. Observ. Potsdam 7 (1892) 166 pp.; Beibl. (1893) 128.
- , *H. W.* Chem. Centralbl. (1886) 785.
- . Verh. d. physikal. Ges. Berlin 10 (1891) 35-46.
- . Photogr. Mittheil. 31 (1895) 367-369; Beibl. (1895) 422.
- Weber, L.* Astron. Nachr. (1887) 17-22; Beibl. (1888) 663.
- . Ann. Phys. n. F. 31 (1887) 676.
- . Beibl. (1889) 78, 883.
- . Beibl. (1897) 411.
- Weigl, Al.* Ztsch. f. physikal. Chem. 11 (1893) 227-247.
- Weiss, P.* C.-R. 128 (1899) 876-877.
- Wellmann, V.* Diss., Berlin, 1887; Beibl. (1887) 705.
- . Beobacht. Sternwarte Potsdam (1892) 75-79.
- Whitman, F. P.* Phys. Rev. 3 (1896) 241-249.
- Wien, W., und Lummer, O.* Ann. Phys. n. F. 56 (1895) 451-456.
- Wilsing, J.* Astron. Nachr. 142 (1897) 241-251.
- Winter, W.* Repert. d. Phys. 24 (1888) 471-485.
- Wolf, M.* Astron. Nachr. 126 (1890) 81-86, 354; Beibl. (1891) 354.
- Wroblewsky, A.* Beibl. (1897) 513.
- Zeeman, P.* Versl. Akad. Amsterdam 4 (1896) 116-119; 148-152; Beibl. (1896) 528.
- . Phil. Mag. (5) 45 (1898) 197-201.
- Zenger, C. V.* Nature 52 (1895) 356-357.
- Zenker, W.* Ztsch. f. Instrum. 7 (1887) 1-7; Beibl. (1887) 442.

## STRONTIUM.

- Baldwin, C. W.* Phys. Rev. 3 (1895-1896) 452.  
*Eder, J. M., und E. Valenta.* Denkschr. d. Wiener Akad. 60 (1893) 467-476.  
*Exner, F., und Haschek, F.* Sitzb. Wiener Akad. 106 (1897) 1127-1152.  
*Humphreys, W. J.* Astrophys. J. 6 (1897) 169-232.  
*Lommel, E.* Ann. Phys. n. F. 30 (1887) 47.  
*Mourelle, J. R.* C.-R. 124 (1897) 1024-1026, 1237-1239; 125 (1897) 775-780; 126 (1898) 420-423, 904-906, 1508-1510; 127 (1898) 229-232, 361-364, 372-374; 128 (1899) 427-429, 557-559, 1239-1241; Beibl. (1897) 741; (1898) 847; (1899) 252.

## SULPHUR.

- Ames, J. S.* Astron. and Astrophys. 12 (1893) 50-51; Beibl. (1893) 827.  
*Bacchi, P.* Mem. Spettro. Ital. 28 (1899) 97-102, 121-129; Beibl. (1899) 636.  
*Baumhauer, H.* Ztsch. f. Krystall. u. Min. 17 (1889) 608-609.  
*Blanchard, C. T.* Nature 50 (1894) 571.  
*Eder, J. M., u. E. Valenta.* Denkschr. d. Wiener Akad. 67 (1898) 55 pp.; Beibl. (1898) 773.  
*Engel, C.-R.* 112 (1891) 866-868.  
*Gladstone, J. H.* Rept. Brit. Assoc. (1892) 679.  
*Gouy, C.-R.* 103 (1886) 244.  
*Gramont, A. de.* C.-R. 119 (1894) 68-70; 122 (1896) 1326-1328; Beibl. (1896) 693.  
*Hasselberg, B.* Astron. and Astrophys. 12 (1893) 347-349; Beibl. (1894) 86.  
*Henry, Ch.* C.-R. 115 (1892) 505-507; Beibl. (1893) 208.  
 — et *G. Seguy.* C.-R. 122 (1896) 1198-1200; 123 (1896) 400-401.  
*Higgs, G.* Proc. Roy. Soc. 49 (1891) 345-346; Beibl. (1891) 518.  
*Hoffman, L., und Kruess, G.* Ber. chem. Ges. 20 (1887) 2369-2376.  
*Hove, J. L., and Hammer, S. G.* J. Amer. Chem. Soc. 20 (1898) No. 10; Beibl. (1899) 178.  
*Kester, Fr. E.* Phys. Rev. 9 (1899) 164-176.  
*Klatt, V., und Ph. Lenard.* Ann. Phys. n. F. 38 (1889) 90.  
*Lescœur, H.* Bull. Soc. chim. Paris (2) 46 (1886) 443.  
*Lommel, E.* Ann. Phys. n. F. 30 (1887) 47.

- Magnanini*. Rend. Accad. Roma 7 (1891) 104-112.  
*Moreau, G.* Ann. chim. phys. (7) 1 (1884) 227-259.  
*Mourelot, J. R.* (See under STRONTIUM, just above.)  
*Muthmann, W.* Ztsch. f. Kryst. u. Min. 17 (1889) 336-337.  
*Nasini, R., e A. Scala.* Atti Accad. Roma 2 (1886) 617-623; Beibl. (1886) 695.  
 — — e *T. Costa.* Rend. Accad. Roma (4) 6 (1890) 284; Jahresb. (1890) 389.  
 — —. Rend. Accad. Roma 7 (1891) 623-631; Beibl. (1892) 146-148.  
 — —. Reg. Univ. Roma, 1st. chim., 1891, 147 pp.; Beibl. (1893) 111.  
 — —. Gazz. chim. Ital. 24 (1894) 256-291; Beibl. (1894) 834.  
*Nichols, E. L.* Phys. Rev. 2 (1895) 267.  
*Paterson, D.* J. Chem. Soc. 67 (1895) 66-68.  
*Rancken, E.* Diss. Helsingfors, 1897, 52 pp.; Beibl. (1899) 97.  
*Rigollot, H.* C.-R. 121 (1895) 164-166.  
*Runge, C., und F. Paschen.* Ann. Phys. n. F. 61 (1897) 641-686.  
*Sabatier, P.* C.-R. 112 (1891) 862-864.  
*Schranf, A.* Ann. Phys. n. F. 27 (1886) 300.  
 — —. Ztsch. f. Kryst. 12 (1886) 321.  
 — —. Wiener Anzeiger (1890) 105-106; Z. Kryst. u. Min. 18 (1890) 113-173.  
*Schuster, A.* Nature 57 (1897) 320-321; Beibl. (1898) 400.  
*Smith.* Rev. scientif. 52 (1893) 410; Beibl. (1893) 1070.  
*Spring, W.* Bull. Acad. Belg. (3) 30 (1895) 311-320; Ztsch. physikal. Chem. 18 (1895) 553-559.  
*Troost, L., et L. Ouvarod.* C.-R. 121 (1895) 788-800.  
*Verneuil, A.* C.-R. 103 (1886) 600; Jahresb. (1886) 395.  
*Wadsworth, F. L. O.* Astrophys. J. 4 (1896) 308.  
*Whitney, W. R.* Ztsch. physikal. Chem. 20 (1896) 40-68.  
*Zsigmondy, R.* Beibl. (1889) 682.

## SWAN'S SPECTRUM.

- Eder, J. M.* Wiener Anzeiger (1890) 103-105.

## SYLVIN.

- Rubens, H., und B. W. Snow.* Ann. Phys. n. F. 46 (1892) 529.  
 — —. Verh. d. physikal. Ges. Berlin 15 (1896) 108-110; Beibl. (1897) 130.  
 — — und *A. Trowbridge.* Ann. Phys. n. F. 60 (1897) 724-739.

## TANTALUM.

*Humphreys, W. J.* *Astrophys. J.* 6 (1897) 169-232.

## TELLURIC RAYS.

*Cornu, A.* *Ann. chim. phys.* (6) 7 (1886) 5-102; *Beibl.* (1887) 37.

*Deslandres, H.* *C.-R.* 100 (1885) 854; *Jahresb.* (1885) 319.

*Janssen, J.* *C.-R.* 107 (1888) 672-677; *Beibl.* (1889) 383.

*Melander, G.* *Oefvers. Finska Forh.* 39 (1897) 9 pp.; *Beibl.* (1899) 178.

*Rizzo, G. B.* *Mem. Spettr. Ital.* 20 (1891) 10; *Beibl.* (1891) 645.

## TELLURIUM.

*Gramont, A. de.* *C.-R.* 127 (1898) 866-868.

*Michaelis, A.* *Ber. chem. Ges.* 20 (1887) 2488-2492; *Beibl.* (1887) 778.

## TEMPERATURE.

*Cassie, W.* *Proc. Roy. Soc.* 49 (1891) 343-345.

*Cusack, R.* *Nature* 56 (1897) 102; *Beibl.* (1897) 978.

*Deslandres, H.* *C.-R.* 121 (1895) 414-418.

*Eder, J. M., und Valenta, E.* *Denkschr. d. Wiener Akad.* 61 (1894) 347-364.

*Franklin, W. S.* *Sci. n. s.* 9 (1899) 594-595.

*Gray, P. L.* *Phil. Mag.* (5) 37 (1894) 549-557; *Beibl.* (1894) 908.

*Guillaume, Ch. Ed.* *La Nature* 22 (1895) 99; *Beibl.* (1895) 329.

*Hartley, W. N.* *Proc. Roy. Soc.* 54 (1892) 5-7; *Beibl.* (1893) 1055.

*Koch, G. R.* *Ann. Phys. n. F.* 38 (1889) 213.

*Kundt, A.* *Sitzb. Berliner Akad.* (1888) 1387-1394.

*Kuribaum, F.* *Ann. Phys. n. F.* 61 (1897) 417-435.

*MacGregor, J. G.* *Trans. Roy. Soc. Canada III* (1891) 27-41; *Beibl.* (1893) 123.

*Mallard et Le Chatellier.* *Ann. chim. phys.* (6) 6 (1895) 90-115.

*Muller, G.* *Pub. astrophys. Observ. Potsdam* 4 (1885) 151-216.

*Nichols, E. L., and B. W. Snow.* *Phil. Mag.* (5) 32 (1891) 401-424.

— — — and *M. C. Spencer.* *Phys. Rev.* 2 (1895) 344-360.

*Pellat.* *Bull. Soc. philomath. Paris* (1886) 155-160; *Beibl.* (1887) 705.

*Perkin, W. H.* *Chem. News* 63 (1891) 18-21.

— — —. *J. Chem. Soc.* (5) 61-62 (1892) 287-310.

— — —. *J. Chem. Soc.* 67-68 (1895) 1-7



- Pettinelli, P.* Nuov. Cim. (4) 1 (1895) 183-186; Beibl. (1895) 633.  
 ——. Nuov. Cim. (4) 2 (1895) 156-159; Beibl. (1896) 369.  
 ——. Nuov. Cim. (4) 2 (1895) 356-359; Beibl. (1896) 534.  
*Pflüger, A.* Ann. Phys. n. F. 58 (1896) 493-499.  
*Pictet, R.* C.-R. 114 (1892) 1245-1248.  
*Pulfrich, C.* Ann. Phys. n. F. 59 (1896) 671.  
*Quinan, W. R.* J. Amer. Chem. Soc. 17 (1895) 477-483.  
*Rayleigh, Lord.* Phil. Mag. (5) 27 (1889) 460-469.  
*Rizzo, G. B.* Mem. Spettr. Ital. 20 (1891) 10 pp.; Beibl. (1891) 645.  
 ——. Atti Accad. Torino 28 (1893) 465-478; Beibl. (1893) 1059.  
*Roberts-Austen, W. C.* Nature 45 (1892) 534-541.  
*St. John, Charles E.* Ann. Phys. n. F. 56 (1895) 433-450.  
*Schrauf, A.* Ztsch. f. Kryst. u. Min. 18 (1890) 113-173; Beibl. (1891) 37.  
*Schumann, V.* Jahresb. f. Photogr. (1893) 160-165; Beibl. (1893) 1030.  
*Sella, A.* Rend. Accad. Roma 7 (1891) 300-308; Beibl. (1892) 423.  
*Smithells, A.* J. Chem. Soc. 67-68 (1895) 1149-1163.  
*Spring, W.* Ztsch. physikal. Chem. (3) 30 (1895) 311-320.  
*Violle, J.* C.-R. 114 (1892) 734-737.  
*Warburg, E.* Ann. Phys. n. F. 54 (1895) 265-275.  
 ——. Verh. d. physikal. Ges. Berlin 14 (1896) 78-83.  
*Wellmann, V.* Beobacht. Sternwarte Potsdam (1892) 75-79.  
*Wien, W.* Ann. Phys. n. F. 52 (1894) 132.  
*Wilson, W. E., and P. L. Gray.* Phil. Trans. 185 (1894) 361-396.  
*Wood, R. W.* Phys. Rev. 4 (1896) 191-206; Ann. Phys. n. F. 59 (1896) 238-251.

## TERBIUM.

- Boisbaudran, F. Lecoq de.* C.-R. 121 (1895) 709.

## THALLIUM.

- Humphreys, W. J.* Astrophys. J. 6 (1897) 169-232.  
*Kayser, H., und C. Runge.* Ann. Phys. n. F. 48 (1893) 126.  
*Wilde, H.* Proc. Roy. Soc. 52 (1892-1893) 369-372.  
 ——. C.-R. 125 (1897) 708-709.

## THICKNESS, Influence on the Spectrum.

- Ebert, H.* Ann. Phys. n. F. 33 (1888) 155-159.  
*Hallwachs, W.* Ann. Phys. n. F. 53 (1894) 1.

- Müller-Erbach, W. Wiener Anzeiger (1889) 50-52, 327-339.  
———. Verh. deutsch. Naturf. u. Aerzte (1895) 70-72.  
———. Sitzb. Wiener Akad. 105 (1896) 263-289.  
Wullner, A. Ann. Phys. n. F. 34 (1888) 647-662.

## THORIUM.

- Curie, Mme S. C.-R. 126 (1898) 1101-1103.  
Humphreys, W. J. Astrophys. J. 6 (1897) 169-232.  
Lohse, O. Sitzb. d. Berliner Akad. (1897) 29 pp.  
Schmidt, G. C. C.-R. 126 (1898) 1264.

## THULIUM.

- Forstling, S. Svensk. Vet. Akad. Handl. 24 (1898) 1-35.

## TIN.

- Brauns, R. Neues Jahrb. f. Min. Geol. u. Paleont. 2 (1891) 12-20.  
Humphreys, W. J. Astrophys. J. 6 (1897) 169-232.  
Kayser, H., und Runge, C. Ann. Phys. n. F. 52 (1894) 1; Beibl. (1894) 93.  
Liebermann, C., und Finkenbeiner, H. Ber. chem. Ges. 26 (1893) 833-834.  
——— und Hartmann, A. Ber. chem. Ges. 26 (1893) 829-833.

## TITANIUM.

- Exner, F., und Haschek, E. Wiener Anzeiger (1898) 13-19.  
———, ———. Sitzb. Wiener Akad. 107 (1898) 792-812.  
Frost, E. B. Astrophys. J. 10 (1899) 207.  
Hasselberg, B. Svensk. Vet. Akad. Handl. 28 (1896) 32 pp.; Beibl. (1896) 306.  
Humphreys, W. J. Astrophys. J. 6 (1897) 169-232.

## TUNGSTEN.

- Humphreys, W. J. Astrophys. J. 6 (1897) 169-232.

## ULTRA-RED.

- Ångström, K. Phys. Rev. (1892) 597-624; Beibl. (1896) 196.  
Kayser, H., und C. Runge. Ann. Phys. n. F. 48 (1893) 150.  
Königsberger, J. Ann. Phys. n. F. 61 (1897) 687-704.  
Lommel, E. Ann. Phys. n. F. 40 (1890) 681, 687.

- Paschen, F.* Ann. Phys. n. F. 53 (1894) 301, 334-336, 337-344 (1895) 762-767.  
*Ransohoff, M.* Diss., Berlin; Beibl. (1897) 737.  
*Rubens, H.* Verh. d. physikal. Ges. Berlin 10 (1891) 83-84  
 ——. Ann. Phys. n. F. 51 (1894) 381.  
 ——. Verh. d. physikal. Ges. Berlin 15 (1896) 108-110. (1897) 130.  
 ——. Ann. Phys. n. F. 60 (1897) 724-739.  
*Snow, B. W.* Ann. Phys. n. F. 47 (1892) 208.

## ULTRA VIOLET.

- Battelli, A., e A. Garbasso.* Nuov. Cim. (4) 3 (1896) 321-324  
*Beattie, J. C., et S. de Smolan.* Phil. Mag. (3) 48 (1897) 418-431  
*Bell, L.* Amer. J. Sci. (3) 31 (1886) 426-431.  
*Blyth, A. W.* Chem. News 80 (1899) 32.  
*Borel, G. A.* Arch. de Genève 34 (1895) 134-157, 230-249; (1896) 42.  
*Buisson, H.* C.-R. 127 (1898) 224-227; Beibl. (1898) 803  
*Buss, O.* Beibl. (1897) 130  
*Candolle, C. de.* Arch. de Genève 28 (1892) 265-277.  
*Cornu, A.* J. de phys. 5 (1886) 341-354; Beibl. (1887) 582  
 ——. C.-R. 108 (1889) 1211-1217; 111 (1890) 941 947; (1891) 205.  
*Deslandres, H.* Ann. chim. phys. (6) 15 (1888) 5-86; Beibl. (1888) 809-810.  
 ——. C.-R. 106 (1888) 842-856.  
 ——. C.-R. 120 (1895) 707-710; Beibl. (1895) 33.  
*Dussaud.* C.-R. 128 (1899) 171  
*Eder, J. M.* Wiener Anzeiger (1890) 103-105; Beibl. (1890) 7  
 ——. Wiener Anzeiger (1892) 252 253  
 ——. u. E. Valenta. Wiener Anzeiger (1893) 21-24.  
 ——. Denkschr. d. Wiener Akad. 60 (1893) 24 pp.; (1894) 910-912,  
 ——. u. E. Valenta. Denk. d. Wien. Akad. 60 (1893) 241 307-311, 467-476; Beibl. (1894) 909.  
 ——. Denk. d. Wien. Akad. 61 (1894) 285-295  
 ——. Verh. deutsch. Naturf. u. Aerzte (1895) 78.  
*Elster, J., und Geitel, H.* Separatabdr. d. Wiener Akad. 10 703-856.  
*Exner, F., und Haschek, E.* Sitzb. Wiener Akad. 104 IIa (1895) 962; 105 IIa (1896) 389 436, 503-574, 707-740, 980-1013; IIa (1897) 36 68, 337 356, 1127-1152; Beibl. (1896) 693

- ner, F., und Haschek, E. Sitzb. Wiener Akad. 107 (1898) 182-260, 818-837, 1835-1880.
- rsling, S. Svensk. Vet. Akad. Handl. 18 I (1893) 23 pp.; Beibl. (1894) 562.
- mgee, A. Proc. Roy. Soc. 49 (1896) 276-279; Beibl. (1896) 696.
- itel, W. Verh. deutsch. Naturf. u. Aerzte (1890) 501.
- aebe, H. Diss., Dorpat, 1892; Beibl. (1896) 127.
- le, G. E. Amer. J. Sci. (3) 42 (1891) 459-467; Beibl. (1893) 126.
- rtley, W. N. Rept. Brit. Assoc. (1885) 276-284; Beibl. (1888) 194.
- — — and Dobbie, J. J. Chem. Soc. 73 (1898) 598-606.
- ischek, E. Wiener Anzeiger (1896) 75.
- nry, J. Proc. Cambridge Phil. Soc. 9 (1897) 319-322.
- rmann, Th. S. Ann. Phys. n. F. 59 (1896) 91-115.
- rtz, H. Sitzb. Berliner Akad. (1887) 487-490.
- or, M. Repert. d. Phys. 25 (1889) 91-119; Wiener Anz. (1888) 118.
- uggins, W. Proc. Roy. Soc. 45 (1889) 544; 46 (1889) 133-135.
- —. C.-R. 10 (1890) 1310-1311; Beibl. (1890) 790.
- —. Astrophys. J. (1895) 359-365; Beibl. (1896) 196.
- upe, A. Programm, Realschule Charlottenburg, Ostern, 1894.
- elvin, Lord, and S. de Smolan. Nature 55 (1887) 343-347.
- —, J. C. Beattie, and S. de Smolan. Edinb. Proc. (1897) 393.
- —. Phil. Mag. (5) 46 (1898) 494-500; Nature 59 (1898) 56-57.
- ohl, F. G. Naturwiss. Rundschau 12 (1897) 425.
- nard, P., und M. Wolf. Ann. Phys. n. F. 37 (1889) 443-457.
- veing, G. D., and Dewar, J. Phil. Mag. (5) 26 (1888) 286-291.
- , ——. Phil. Trans. 179 (1888) 231-256; Beibl. (1889) 380.
- hse, O. Sitzb. Berliner Akad. 12 (1897) 179-197.
- erritt, E. Phys. Rev. 5 (1897) 306-309; Beibl. (1898) 245.
- ichols, E. Phys. Rev. 2 (1895) 298, 305; Beibl. (1895) 426.
- iewenglowski, G. H. Paris: Desforges, 1896, 23 pp.
- uer, J. Ann. Phys. n. F. 61 (1897) 363-379.
- veau, C. J. de phys. (3) 5 (1896) 113-114.
- eport of the Committee. Rept. Brit. Assoc. (1885) 276-284; (1891) 147-148; (1892) 74-76.
- ighi, A. Rend. Accad. Roma 5 (1889) 860-862.
- ubens, H., und E. Ashkinass. Ann. Phys. n. F. 64 (1898) 584-601.
- Runge, C. Ann. Phys. n. F. 55 (1895) 44-48.
- Rutherford, E. Proc. Roy. Soc. Cambridge 9 (1898) 401-417; Beibl. (1898) 895.
- Sachs, J. von. Beibl. (1888) 105.

- Paschen, F.* Ann. Phys. n. F. 53 (1894) 301, 334-336, 337-342; 56 (1895) 762-767.
- Ransohoff, M.* Diss., Berlin; Beibl. (1897) 737.
- Rubens, H.* Verh. d. physikal. Ges. Berlin 10 (1891) 83-84.
- . Ann. Phys. n. F. 51 (1894) 381.
- . Verh. d. physikal. Ges. Berlin 15 (1896) 108-110; Beibl. (1897) 130.
- . Ann. Phys. n. F. 60 (1897) 724-739.
- Snow, B. W.* Ann. Phys. n. F. 47 (1892) 208.

## ULTRA-VIOLET.

- Battelli, A., e A. Garbasso.* Nuov. Cim. (4) 3 (1896) 321-324.
- Beattie, J. C., et S. de Smolan.* Phil. Mag. (3) 48 (1897) 418-439.
- Bell, L.* Amer. J. Sci. (3) 31 (1886) 426-431.
- Blyth, A. W.* Chem. News 80 (1899) 32.
- Borel, G. A.* Arch. de Genève 34 (1895) 134-157, 230-249; Beibl. (1896) 42.
- Buisson, H.* C.-R. 127 (1898) 224-227; Beibl. (1898) 803.
- Buss, O.* Beibl. (1897) 130.
- Candolle, C. de.* Arch. de Genève 28 (1892) 265-277.
- Cornu, A.* J. de phys. 5 (1886) 341-354; Beibl. (1887) 582.
- . C.-R. 108 (1889) 1211-1217; 111 (1890) 941-947; Beibl. (1891) 205.
- Deslandres, H.* Ann. chim. phys. (6) 15 (1888) 5-86; Beibl. (1889) 809-810.
- . C.-R. 106 (1888) 842-856.
- . C.-R. 120 (1895) 707-710; Beibl. (1895) 33.
- Dussaud.* C.-R. 128 (1899) 171.
- Eder, J. M.* Wiener Anzeiger (1890) 103-105; Beibl. (1890) 780.
- . Wiener Anzeiger (1892) 252-253.
- u. *E. Valenta.* Wiener Anzeiger (1893) 21-24.
- . Denkschr. d. Wiener Akad. 60 (1893) 24 pp.; Beibl. (1894) 910-912,
- u. *E. Valenta.* Denk. d. Wien. Akad. 60 (1893) 241-262, 307-311, 467-476; Beibl. (1894) 909.
- , ———. Denk. d. Wien. Akad. 61 (1894) 285-295.
- , ———. Verh. deutsch. Naturf. u. Aerzte (1895) 78.
- Elster, J., und Geitel, H.* Separatabdr. d. Wiener Akad. 10 (1892) 703-856.
- Exner, F., und Haschek, E.* Sitzb. Wiener Akad. 104 IIa (1895) 909-962; 105 IIa (1896) 389-436, 503-574, 707-740, 989-1013; 106 IIa (1897) 36-68, 337-356, 1127-1152; Beibl. (1896) 693.

- Exner, F., und Haschek, E.* Sitzb. Wiener Akad. 107 (1898) 182-260, 818-837, 1835-1880.
- Forsling, S.* Svensk. Vet. Akad. Handl. 18 I (1893) 23 pp.; Beibl. (1894) 562.
- Gamgee, A.* Proc. Roy. Soc. 49 (1896) 276-279; Beibl. (1896) 696.
- Geitel, W.* Verh. deutsch. Naturf. u. Aerzte (1890) 501.
- Grache, H.* Diss., Dorpat, 1892; Beibl. (1896) 127.
- Hale, G. E.* Amer. J. Sci. (3) 42 (1891) 459-467; Beibl. (1893) 126.
- Hartley, W. N.* Rept Brit Assoc. (1885) 276-284; Beibl. (1888) 194.
- and *Dobbie, J.* J. Chem. Soc. 73 (1898) 598-606.
- Haschek, E.* Wiener Anzeiger (1896) 75.
- Henry, J.* Proc. Cambridge Phil. Soc. 9 (1897) 319-322.
- Hermann, Th. S.* Ann Phys. n. F. 59 (1896) 91-115.
- Hertz, H.* Sitzb. Berliner Akad. (1887) 487-490.
- Hoor, M.* Rept. d. Phys. 25 (1889) 91-119; Wiener Anz. (1888) 118.
- Huggins, W.* Proc. Roy. Soc. 45 (1889) 544; 46 (1889) 133-135.
- . C.-R. 10 (1890) 1310-1311; Beibl. (1890) 790.
- . Astrophys. J. (1895) 359 365; Beibl. (1896) 196.
- Hupe, A.* Programm, Realschule Charlottenburg, Ostern, 1894.
- Kelvin, Lord, and S. de Smolan.* Nature 55 (1887) 343-347.
- . J. C. Beattie, and S. de Smolan. Edinb. Proc. (1897) 393.
- . Phil. Mag. (5) 46 (1898) 494-500; Nature 59 (1898) 56-57.
- Kohl, F. G.* Naturwiss. Rundschau 12 (1897) 425.
- Lenard, P., und M. Wolf.* Ann. Phys. n. F. 37 (1889) 443-457.
- Liveing, G. D., and Dewar, J.* Phil. Mag. (5) 26 (1888) 286-291.
- . Phil. Trans. 179 (1888) 231-256; Beibl. (1889) 380.
- Lohse, O.* Sitzb. Berliner Akad. 12 (1897) 179-197.
- Merritt, E.* Phys. Rev. 5 (1897) 306-309; Beibl. (1898) 245.
- Nichols, E.* Phys. Rev. 2 (1895) 298, 305; Beibl. (1895) 426.
- Niewenglowski, G. H.* Paris: Desforges, 1896, 23 pp.
- Pauer, J.* Ann. Phys. n. F. 61 (1897) 363-379.
- Raveau, C.* J. de phys. (3) 5 (1896) 113-114.
- Report of the Committee.* Rept. Brit. Assoc. (1885) 276-284; (1891) 147-148; (1892) 74-76.
- Righi, A.* Rend. Accad. Roma 5 (1889) 860-862.
- Rubens, H., und E. Ashkinass.* Ann. Phys. n. F. 64 (1898) 584-601.
- Runge, C.* Ann. Phys. n. F. 55 (1895) 44-48.
- Rutherford, E.* Proc. Roy. Soc. Cambridge 9 (1898) 401-417; Beibl. (1898) 895.
- Sachs, J. von.* Beibl. (1888) 105.

- Sandrucci, A.* Rend. Accad. Roma (5) 7 (1898) 100-108.  
*Schjerning, W.* Beibl. (1887) 340.  
*Schumann, V.* Wiener Anzeiger (1892) 231.  
 ——. Sitzb. Wiener Akad. 102 (1893) 994-1024.  
 ——. Astrophys. J. 3 (1896) 144-155, 220-226, 387-394.  
*Schunck, C. A.* Proc. Roy. Soc. 63 (1898) 389-396; Beibl. (1898) 776.  
*Sella, A., e Q. Majorana.* Atti Accad. Roma 5 (1896) 323-327, 389-392.  
*Simon, H. Th.* Ann. Phys. n. F. 53 (1894) 542; 59 (1896) 91-115.  
*Simony, O.* Beibl. (1892) 152.  
*Smith, A. P.* Chem. News 61 (1890) 292-293; Jahresb. (1890) 384.  
*Smyth, C. P.* Rept. Brit. Assoc. (1891) 147, 573; Beibl. (1892) 610.  
 ——. Rept. Brit. Assoc. (1892) 74-76; Beibl. (1893) 829.  
*Soret, J. L.* Arch. de Genève (3) 18 (1887) 344-346; Beibl. (1888) 246.  
 ——. et *A. Rilliet.* C.-R. 110 (1890) 137-139; Beibl. (1890) 373.  
*Swyngedauw, R.* C.-R. 122 (1896) 131-134, 1052-1054.  
*Trowbridge, J., and Sabine, W. C.* Phil. Mag. (5) 26 (1888) 316, 342; Beibl. (1889) 18.  
*Verneuil, A.* C.-R. 103 (1886) 600; Jahresb. (1886) 395.  
*Wallach, O.* Göttinger Nachr. (1896) 9 pp.; Beibl. (1897) 633.  
*Widmark.* Archiv f. Physiol. 3 (1891) 463-502.  
*Wiedemann, E., und Schmidt, G. C.* Jahresb. f. Photogr. (1896) 15.  
*Wild, J., und Harker, J.* Beibl. (1897) 590.  
*Wilson, C. T. R.* Proc. Roy. Soc. 64 (1898) 127-130; Beibl. (1898) 562.  
 ——. Proc. Phil. Soc. Cambridge 9 (1898) 392-393.  
*Zeleny, J.* Phil. Mag. (5) 45 (1898) 272-273.  
*Zickler, K.* Electrician 41 (1898) 720-722.

## URANIUM.

- Beattie, J. C., and S. de Smolan.* Phil. Mag. (5) 43 (1897) 418-439; Beibl. (1898) 184.  
*Becquerel, H.* C.-R. 122 (1896) 501, 559, 689, 762, 1086; 123 (1896) 855; Astrophys. J. 5 (1897) 66.  
 ——. C.-R. 124 (1897) 438-444; 128 (1899) 771-777.  
*Bruttini, A.* Gazz. chim. Ital. (1893) 251-257; Beibl. (1893) 927.  
*Campanile, F., e E. Stromci.* Nuov. Cim. (4) 6 (1897) 417-421; Beibl. (1898) 702.  
*Curie, Mme. S.* C.-R. 126 (1898) 1101-1103.



- Exner, F., und Haschek, E.* Sitzb. Wiener Akad. 107 (1898) 1335-1380.
- Humphreys, W. J.* Astrophys. J. 6 (1897) 169-232.
- Kelvin, Lord, J. C. Beattie, and S. de Smolan.* Proc. Roy. Soc. Edinb. 21 (1897) 393-428.
- Lohse, O.* Abhandl. d. Berliner Akad. 1897. 29 pp.
- Moissan, H.* C.-R. 122 (1896) 1088-1093.
- Russell, W. J., and Lapraik, W.* Report. Brit. Assoc. (1886) 576; Beibl. (1887) 822.
- Sagnac, G.* J. de phys. (3) 5 (1896) 193-302.
- Spies, P.* Verh. d. physikal. Ges. Berlin 15 (1896) 101.
- Troost, L.* C.-R. 122 (1896) 694.
- Wilson, C. T. R.* Proc. Roy. Soc. 64 (1898) 127-130.

## VACUUM TUBE SPECTRA.

- Campbell, W. W.* Astrophys. J. 9 (1899) 312.
- Dewar, James.* Proc. Roy. Soc. 64 (1899) 231-238; Beibl. (1899) 415.
- Ferry, E. S.* Phys. Rev. 7 (1898) 1-9; Beibl. (1898) 900.
- Hamy, M.* C.-R. 126 (1898) 231-234.
- Hutchins, C. C.* Amer. J. Sci. (4) 6 (1898) 61-64.
- Salomons, D.* Proc. Roy. Soc. 56 (1894) 229-250.
- Schumann, V.* Astron. and Astrophys. 12 (1893) 159-166; Beibl. (1893) 826.
- Smyth, C. P.* Rept. Brit. Assoc. (1889) 490; Beibl. (1890) 119.

## VANADIUM.

- Hasselberg, B.* Bik. Svensk. Akad. Handl. 22 (1897) 7 pp.; Beibl. (1897) 227.
- . Mem. Spettr. Ital. 28 (1899) 113-119; Astrophys. J. 9 (1899) 143-148.
- . Svensk. Akad. Handl. 32 (1899) 38 pp.; Beibl. (1899) 634, 785.
- Humphreys, W. J.* Astrophys. J. 6 (1897) 169-232.
- Rowland, H. A and C. N. Harrison.* Astrophys. J. 7 (1898) 273-294.

## VICTORIUM.

- Crookes, W.* Chem. News 80 (1899) 49-52.

## VIOLET, see ULTRA-VIOLET.

## WATER.

- Bruehl, J. W.* Ber. chem. Ges. 30 (1897) 162-172.
- Cohen, E.* Ztsch. f. physikal. Chem. 28 (1899) 145-153.

- Cole, A. D.* Phys. Rev. 4 (1896) 50-61.  
*Conroy, J.* Proc. Roy. Soc. 58 (1895) 228-234; Beibl. (1895) 881.  
*Hüfner, G.* Archiv. f. Anat. u. Physiol. (1891) 88-102; Beibl. (1891) 515.  
*Janssen, J.* Bull. Soc. astron. France (1896) 226-227.  
*Jewell, L. E.* Astrophys. J. 4 (1896) 324-342; 5 (1897) 279-281.  
*MacGregor, J. G.* Trans. Roy. Soc. Canada III (1891) 27-41; Beibl. (1893) 123.  
 — — —. Phil. Mag. (5) 43 (1897) 99-100.  
*Marx, E.* Göttinger Nachr. (1898) 3 pp.  
*Mazzotto, D.* Nuov. Cim. 5 (1897) 55-57.  
*Meyer, G.* Ann. Phys. (2) 31 (1887) 321.  
*Mohler, J. F.* Phys. Rev. 4 (1896) 153-158.  
*Paschen, F.* Ann. Phys. n. F. 53 (1894) 334-336.  
*Pulfrich, C.* Ann. Phys. n. F. 34 (1888) 326.  
*Rayleigh, Lord.* Proc. Roy. Soc. 45 (1889) 425-430; Chem. News 59 (1889) 147.  
 — — —. Chem. News 62 (1890) 1-4, 17-19.  
 — — —. Phil. Mag. (5) 34 (1892) 309-320; Beibl. (1893) 833.  
*Riccó, A.* Mem. Spettr. Ital. 18 (1889) 3 pp.  
*Saunders, F. A.* Johns Hopkins Univ. Cir. 18 (1899) 58-59.  
*Soret, J. L., et Sarasin, E.* C.-R. 108 (1889) 1248.  
*Spring, W.* Ztsch. anorg. Chem. 12 (1896) 253-261; Beibl. (1896) 535.  
 — — —. Bull. Acad. Belg. 37 (1899) 72-81.  
*Verschaffelt, J.* Bull. Acad. Belg. 32 (1894) 49-84; Beibl. (1894) 833.  
*Vogel, H. W.* Ann. Phys. n. F. 54 (1895) 175-177.

## WAVE-LENGTHS.

- Ames, J. S.* Phil. Mag. (5) 30 (1890) 33-48; Jahresb. (1890) 397.  
*Angström, K.* Ann Phys. n. F. 36 (1889) 715-725.  
*Balmer, J. J.* Ann. Phys. n. F. 60 (1897) 380-391.  
*Basset, A. B.* Proc. Lond. Math. Soc. 22 (1891) 317-329; Beibl. (1892) 72.  
*Becquerel, H.* C.-R. 102 (1886) 209; Jahresb. (1886) 303.  
 — — — et *H. Deslandres.* C.-R. 126 (1898) 997-1001.  
*Bell, L.* Phil. Mag. (5) 25 (1888) 245-263, 350-372.  
*Booth, W.* Dublin Trans. (2) 6 (1897) 205-212.  
*Bose, J. C.* Proc. Roy. Soc. 60 (1896) 167-178.  
*Boussinesq, J.* C.-R. 117 (1893) 80-86, 193-199.  
*Cohen, E., und Zeeman, P.* Versl. Akad. Amsterdam 4 (1896) 108-116.

- Comstock, G. C.* Astrophys. J. 5 (1897) 26-35.  
*Cornu, A.* Ann. Bur. des Longit. A. 1 (1896).  
*Dale, T. P.* Phil. Mag. (5) 25 (1888) 325-338.  
*Deslandres, H.* C.-R. 106 (1888) 739-740; Beibl. (1888) 854.  
*Drude, P., und W. Nernst.* Götting. Nachr. (1891) 346-358.  
 ——. Götting. Nachr. (1892) 366-369, 393-412.  
 ——. Ann. Phys. n. F. 48 (1893) 119.  
 ——. Verh. d. deutsch. Naturf. u. Aerzte II 1 (1899) 80.  
*Dufour, Ch.* Arch. de Genève 24 (1890) 242-255.  
*Ebert, H.* Ann. Phys. n. F. 32 (1887) 337-384; 33 (1888) 136-159.  
*Eder, J. M.* Denkschr. d. Wiener Akad. 60 (1893) 241 pp.; Beibl. (1894) 910-912.  
*Fabry, Ch.* J. de phys. (3) 2 (1893) 22-27; C.-R. 115 (1892) 1063-1064.  
 ——. et A. Perot. C.-R. 126 (1898) 1561-1564, 1624-1626, 1706-1708.  
*Fery, Ch.* C.-R. 126 (1898) 333-335.  
*Fievez, Ch.* Bull. Acad. Belg. 15 (1888) 81-86.  
*Foerster, O.* Ztsch. f. Math. u. Phys. 41 (1896) 258-265.  
*Fomn, L.* Naturwiss. Rundschau 11 (1896) 304.  
*Foussereau, G.* J. de phys. (3) 1 (1892) 144-147; Beibl. (1892) 603.  
 ——. C.-R. 120 (1895) 85-88.  
*Frost, E. B.* Astrophys. J. 10 (1899) 283.  
*Godfrey, C.* Astrophys. J. 8 (1898) 114.  
*Gouy, C.-R.* 110 (1890) 1251-1253; 111 (1890) 33-35; 120 (1895) 915-917; Beibl. (1890) 969.  
*Grosse, W.* Ztsch. phys. chem. Unterr. 5 (1891) 22-24.  
*Hale, G. E.* Astrophys. J. 3 (1895) 384-385; Beibl. (1896) 199.  
*Hartley, W. N., and H. Ramage.* Proc. Roy. Soc. 60 (1897) 35, 393.  
*Heaviside, O.* Proc. Roy. Soc. 54 (1894) 26-30.  
*Henry, Ch.* C.-R. 115 (1892) 505-507; Beibl. (1893) 208.  
*Houston, E. J., and Kennelly, A. E.* Elektrotechn. Ztsch. (1898) 714-716.  
*Huggins, W.* Proc. Roy. Soc. 45 (1889) 430-436; Beibl. (1889) 507.  
 ——. and F. W. Very. Astrophys. J. 6 (1897) 55-56.  
*Humphreys, W. J.* Astrophys. J. 6 (1897) 169-232; Beibl. (1898) 219.  
 ——. and J. P. Mohler. 3 (1895) 114-118; Beibl. (1896) 583.  
*Iearn, C.-R.* 121 (1895) 884-886; Beibl. (1896) 653.  
*Jäger, G.* Arch. de Genève (3) 34 (1895) 376-377.  
*Jaumann, G.* Ann. Phys. n. F. 57 (1896) 147-184.  
*Jewell, L. E.* Astrophys. J. 9 (1899) 211-214; Beibl. (1899) 780.

- Julius, V. A.* Arch. néerland. 28 (1895) 226-235.  
*Keeler, J. E.* Astron. and Astrophys. 12 (1893) 730-736.  
 ———. Astrophys. J. 3 (1896) 63-77; 6 (1897) 144.  
*Kelvin, Lord.* Proc. Roy. Soc. 59 (1896) 270-273.  
 ———. Phil. Mag. (5) 46 (1898) 494-500.  
*Korteweg.* Zitt. Akad. Amsterdam (1897) 3-6.  
*Kurlbaum, F.* Ann. Phys. n. F. 33 (1888) 159-194, 381-413.  
 ———. Ann. Phys. n. F. 61 (1897) 417-435.  
*Lamb, H.* Manchester Lit. Phil. Soc. (1898) 1-20.  
*Lampa, A.* Sitzb. Wiener Akad. 105 (1896) 589-600.  
*Landerer, J. J.* C.-R. 116 (1893) 561-563.  
*Landolt, H., und H. Jahn.* Sitzb. Berliner Akad. (1892) 729-758.  
*Lang.* Sitzb. Wiener Akad. 104 (1895) 980-993; 105 (1896) 252-262.  
*Larmor, J.* Phil. Mag. (5) 35 (1894) 97-106.  
*Le Bon, G.* C.-R. 128 (1899) 297-300.  
*Le Dantec, M.* Paris: Michelet, 1892, 156 pp.  
*Lépinay, J. Macé de.* Ann. chim. phys. (6) 10 (1887) 68-85, 170-200.  
 ———. Ann. chim. phys. (7) 5 (1895) 210-256.  
*Lewis, P. L.* Astrophys. J. (1895) 1-25, 106-108; Beibl. (1896) 28-29.  
*Lie, S.* Verh. sachs. Ges. Leipzig (1896) 131-133; Beibl. (1897) 331.  
*Lockyer, J. N.* Proc. Roy. Soc. 46 (1889) 35-40; Beibl. (1889) 812.  
*Lohschmidt, J.* Sitzb. Wiener Akad. 93 (1886) 434-446.  
*Mach, E., und L.* Sitzb. Wiener Akad. 98 (1889) 1310-1336.  
 ———, *fils.* Soc. franç. de phys. (1893) 283-284.  
*Mater, M.* Ann. Phys. n. F. 68 (1899) 903-916.  
*Matthiessen, E.* Beibl. (1898) 557.  
*Mazzotto, D.* Nuov. Cim. 5 (1897) 55-57.  
*Merczyng, H.* Ann. Phys. n. F. 22 (1884) 129.  
*Meslin, G.* Ann. chim. phys. (7) 3 (1894) 362-408, 563-574.  
*Michelson, A. A., and E. W. Morley.* Phil. Mag. (5) 24 (1887) 463-466.  
 ———. Proc. Amer. Soc. Adv. Sci. (1888) 14 pp.; Beibl. (1889) 496.  
 ——— and E. W. Morley. Amer. J. Sci. (3) 37 (1889) 181-186.  
 ———. C.-R. 116 (1893) 790-794, Beibl. (1894) 625.  
 ———. Soc. franç. de phys. (1893) 3-5, 155-172.  
 ———. Nature 49 (1893) 56-60; J. de phys. 3 (1894) 5-22.  
*Mohler, J. F.* Astrophys. J. 4 (1896) 175-181.  
 ———. Astrophys. J. 10 (1899) 202-206.  
 ——— and L. E. Jewell. Astrophys. J. (1896) 351-355.

- Nasini, R.* Gazz. chim. Ital. (1893) 347-354; Beibl. (1893) 739.
- Nichols, E. F.* Sitzb. Akad. Berlin (1896) 1183-1196.
- . Phys. Rev. 4 (1897) 297-313.
- Nordenskiöld, A. E.* Beibl. (1888) 527-528; C.-R. 105 (1887) 988.
- Palmer, A. De Forest, Jr.* Amer. J. Sci. (3) 50 (1895) 357-359.
- Paschen, F.* Ann. Phys. n. F. 53 (1894) 334-336; 56 (1895) 762-767.
- Perot, A., et Fabry, Ch.* Ann. chim. phys. (7) 16 (1899) 289-338.
- Pfaundler, L.* Ztsch. phys. chem. Unterr. (1887) 98-102.
- Poincaré, H.* C.-R. 113 (1891) 16-18; Beibl. (1892) 603.
- Preston, Thomas.* Phil. Mag. (5) 43 (1897) 458-460.
- Ramsay, W., and M. W. Travers.* Proc. Roy. Soc. 60 (1897) 442-448.
- Rayleigh, Lord.* Phil. Mag. (5) 43 (1897) 259-272; 44 (1897) 356-362.
- Report of the Committee on Wave-Lengths.* Rept. Brit. Assoc. (1887) 624, and every year since then.
- Righi, A.* Rend. Accad. Roma (5) 1 (1892) 189-194.
- . Nuov. Cim. 5 (1897) 466-470.
- Rowland, H. A.* Phil. Mag. (5) 23 (1887) 257-265; Beibl. (1887) 777.
- . Phil. Mag. (5) 27 (1889) 479-484; Beibl. (1889) 677.
- . Phil. Mag. (5) 36 (1893) 49-75.
- . Astrophys. J. 1 (1895) 130-145, 222-231, 295-304, 377-392; 2 (1895) 45-54, 109-118, 188-197, 306-315, 360-369; 3 (1896) 141-146, 201-206; 6 (1897) 384-392; Beibl. (1896) 27, 365, 530, 773. University Press, Chicago, Ill., 1898, 235 pp.
- Rubens, H., und Snow, B. W.* Ann. Phys. n. F. 46 (1892) 529.
- und *E. F. Nichols.* Naturwiss. Rundschau 11 (1896) 545-549.
- . Verh. deutsch. Naturf. u. Aerzte (1897) 54-56.
- und *E. F. Nichols.* Ann. Phys. n. F. 60 (1897) 418-462.
- und *E. Askinass.* Ann. Phys. n. F. 64 (1898) 602-605.
- Runge, C.* Ann. Phys. n. F. 55 (1895) 44-48.
- St. John, C. E.* Phil. Mag. (5) 38 (1894) 425-441; Amer. J. Sci. (3) 48 (1894) 311-325.
- Schumann, V.* Eder's Jahrb. 4 (1890) 158-163; Beibl. (1890) 615.
- . Wiener Anzeiger (1892) 231.
- . Sitzb. Wiener Akad. 102 II (1893) 415-475, 625-694.
- Schuster, A.* Nature 55 (1896) 200, 223.
- Silow, P.* Ztsch. phys. u. chem. Unterr. 9 (1896) 280-281; Beibl. (1897) 223.
- Stoney, G. J.* Phil. Mag. (5) 43 (1897) 273-281, 368-374; 44 (1897) 98-102, 206-211; Beibl. (1897) 964.

- Strunzel, R.* Abh. d. Bayer Akad. (1893) 113-192; Beibl. (1894) 675.  
*Switzer, J. A.* Phys. Rev. 7 (1898) 83-92; Beibl. (1899) 49.  
*Trowbridge, J., and W. Sabine* Phil. Mag. (5) 26 (1888) 342-353.  
 ——. Amer. J. Sci. (3) 48 (1894) 307-311.  
*Tutton, A. E.* Phil. Trans. 185 (1895) 913-943; Ztsch. f. Kryst. (1895) 455.  
*Uthoff, W.* Archiv f. Physiol. (1889) 171-172; Beibl. (1889) 690.  
*Verschaffelt, J.* Bull. Acad. Belg. (1894) 242-246.  
*Vert, G.* C.-R. 123 (1896) 99-100.  
*Voigt, W.* Götting Nachr. (1896) 186-190; Beibl. (1896) 331.  
 ——. Ann. Phys. n. F. 68 (1899) 598-603.  
*Volterra, Rend. Accad. Roma* (5) 1 (1892) 161-170.  
*Wadsworth, F. L. O.* Astrophys. J. 7 (1898) 77-85.  
*Walter, B.* Naturwiss. Rundschau 11 (1896) 322-323.  
*Watts, F. Marshall* Repts. Brit. Assoc. 1887-1900 (Wave-length tables).  
 ——. Index of Spectra. Manchester. Heywood, 1889-1899.  
*Wien, W.* Ann. Phys. n. F. 49 (1893) 633.  
*Wiener, O.* Ann. Phys. n. F. 40 (1890) 203.  
*Wilsing, J.* Astrophys. J. 7 (1898) 317-329; 10 (1899) 269-271.  
*Wright, W. H.* Astrophys. J. 9 (1899) 50.  
*Zeeman, P.* Zitt. Amsterdam (1897-1898) 11-13.

## WINE.

- Hasterlück, A.* Inaug. Diss., Erlangen, 1889; Beibl. (1890) 281.  
*Vogel, H. W.* Ber. chem. Ges. 21 (1888) 1746; Jahresb. (1888) 2605.

## YTTRIUM.

- Bettendorff, A.* Liebig's Ann. 256 (1890) 159-170; 263 (1891) 161-174; 270 (1892) 376-383.  
*Boisbaudran, F. Lecoq de.* C.-R. 103 (1886) 627; Jahresb. (1886) 404.  
 ——. C.-R. 103 (1886) 1536; Jahresb. (1886) 308-310.  
*Broekelmann, K.* Diss., Erlangen, 1891, 21 pp.  
*Crookes, W.* Chem. News 54 (1886) 39, 155; Jahresb. (1886) 403.  
 ——. Chem. News 55 (1887) 25; Jahresb. 357.  
 ——. Chem. News 56 (1887) 59, 62, 72, 81; Jahresb. 358.  
*Humphreys, W. J.* Astrophys. J. 6 (1897) 169-232.  
*Lohse, O.* Abh. d. Berliner Akad. (1897); Astrophys. J. 6 (1897) 95-118.  
*Strohecker, J. R.* J. prakt. Chem. (2) 33 (1886) 132-140.  
*Thalen, R.* Bull. Soc. chim. Paris (2) 22 (1874) 350, from Svensk. Vet. Akad. Handl. 12 (1873).



## ZINC.

- Ames, J. S. *Phil. Mag.* (5) 30 (1890) 33-48.  
 Crew, H. *Astrophys. J.* 4 (1896) 135.  
 Henry, Ch. C.-R. 115 (1892) 505-507; 116 (1893) 98-99; *Beibl.* (1893) 1049.  
 ——. C.-R. 122 (1896) 312-314; 123 (1896) 400-401.  
 ——. et G. Segny. C.-R. 122 (1896) 1198-1200.  
 Heycock and Neville. *Proc. Phil. Soc. Cambridge* 9 (1897) 222-224.  
 Humphreys, W. J. *Astrophys. J.* 6 (1897) 169-232.  
 Jones, A. *Diss., Erlangen*, 1896, 29 pp., *Ann. Phys. n. F.* 62 (1897) 30-53.  
 Nichols, E. L., and B. W. Snow. *Phil. Mag.* (5) 33 (1892) 19-28.

## ZIRCONIUM.

- Drossbach, G. P. *Chemiker Ztng.* 15 (1891) 328; *Beibl.* (1891) 524.  
 Exner, F., und E. Hachsek. *Sitzb. Wiener Akad.* 107 (1898) 792-812.  
 Humphreys, W. J. *Astrophys. J.* 6 (1897) 169-232.  
 Kocks, W. *Dingler's pol. J.* 278 (1890) 235-240; *Beibl.* (1891) 141.  
 Linnemann, Ed. *Monatsh. f. Chem.* 6 (1885) 531-536.  
 Lohse, O. *Abh. d. Berliner Akad.* (1897) 29 pp.; *Astrophys. J.* 6 (1897) 95-118.  
 Schmidt, Fr., und Haensch. *Abh. d. Berliner Akad.* (1888) 6 pp.; *Beibl.* (1888) 244.

## ZODIACAL LIGHT.

- Brenner, L. *Observ.* 19 (1896) 206-207.  
 Corder, H. J. *Brit. Astron. A.* 5 (1895) 305.  
 Gemmill, S. M. B. *Jour. B. A. A.* 5 (1895) 216-217, 306, 360.  
 Hall, M. *Observ.* (1890) 77-79; *Beibl.* (1890) 377.  
 Lynn, W. T. *Observ.* 19 (1890) 274-275.  
 Marchand, E. C.-R. 121 (1895) 1134-1136.  
 Markwick, E. E. *Jour. B. A. A.* 5 (1895) 419.  
 Pickering, E. C. *Harvard Coll. Observ. Annals* (1893) 165-331.  
 Robinson, W. H. *Mon. Not.* 56 (1896) 336.  
 Schuster, A. *Bull. Soc. Belge d'Astron.* 1 (1896) 55-66.  
 Searle, A. *Astron. Nachr.* 124 (1890) 405-408; *Beibl.* (1891) 106.  
 Smith, C. M. *Nature* 42 (1890) 22; 43 (1891) 22. *Beibl.* (1891) 205.  
 Turner, H. H. *Mon. Not.* 56 (1896) 332-336.





SMITHSONIAN MISCELLANEOUS COLLECTIONS.

— 1313 —

A BIBLIOGRAPHY  
OF THE  
ANALYTICAL CHEMISTRY  
OF  
MANGANESE.  
1785-1900.

BY  
HENRY P. TALBOT AND JOHN W. BROWN.



CITY OF WASHINGTON:  
PUBLISHED BY THE SMITHSONIAN INSTITUTION.

1902.

**The Knickerbocker Press, New York**

## LETTER OF TRANSMITTAL.

WASHINGTON, May 11th, 1901.

The Committee on Indexing Chemical Literature, appointed in 1882 by the American Association for the Advancement of Science, has voted to recommend to the Smithsonian Institution for publication the following:

"A Bibliography of the Analytical Chemistry of Manganese, 1785-1900," by Henry P. Talbot and John W. Brown.

This forms one of the following series:

Index to the Literature of Uranium, 1785-1885, by Henry Carrington Bolton, 1885.

Index to the Literature of Columbium, 1801-1887, by Frank W. Traphagen, 1888.

Index to the Literature of the Spectroscope, by Alfred Tuckerman, 1888.

Index to the Literature of Thermodynamics, by Alfred Tuckerman, 1890.

A Bibliography of the Chemical Influence of Light, by Alfred Tuckerman, 1891.

A Bibliography of Aceto-Acetic Ester, by Paul H. Seymour, 1894.

Index to the Literature of Didymium, 1842-1893, by A. C. Langmuir, 1895.

Indexes to the Literature of Cerium and Lanthanum, by W. H. Magee, 1895.

A Bibliography of the Metals of the Platinum Group, by Jas. Lewis Howe, 1897.

Review and Bibliography of the Metallic Carbides, by J. A. Mathews, 1898.

Index to the Literature of Thallium, 1861-1897, by Miss Martha Doan, 1898.

Index to the Literature of Zirconium, by A. C. Langmuir and Charles Baskerville, 1899.

HENRY CARRINGTON BOLTON,  
*Chairman.*

MR. S. P. LANGLEY,  
*Secretary Smithsonian Institution.*

The Subject Index has been based upon such an examination of the original articles as was possible with a reasonable expenditure of time, and is based therefore upon the salient points rather than upon minute details, although an attempt has been made to carry the subdivision of subjects as far as possible. Under the heading "Applications of Quantitative Methods" (page 111 *et seq.*), only those references are, in general, included in which the title of the article specifies the material analyzed. This is particularly true of irons, steels, ferromanganese, and spiegeleisen.

We desire to express our obligation to Dr. H. C. Bolton for the permission to make use of his "Index," as well as for assistance in the examination of a file of journals, and to Mr. A. C. Davis for his valuable assistance in the examination of proof-sheets.

This compilation was made possible by a ready access to the valuable libraries of the Massachusetts Institute of Technology, notably the William Ripley Nichols Chemical Library, but we also wish to express our appreciation of the courtesies extended to us by the Boston Public Library, the Library of the American Academy of Arts and Sciences, the Boston Society of Natural History, the Surgeon-General's Office at Washington, the Library of Congress, the libraries of Yale, Columbia, Lehigh, and Harvard Universities, the Massachusetts College of Pharmacy, and the John Crerar and Astor Libraries. Professor James Lewis Howe's excellent "Bibliography of the Platinum Metals" has served as a model for the arrangement of our data.

HENRY P. TALBOT.  
JOHN W. BROWN.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY,  
BOSTON

JANUARY, 1902.

## LIST OF JOURNALS EXAMINED IN THE PREPARATION OF THIS BIBLIOGRAPHY.

- American Chemical Journal**, 1 (1879)—24 (1900).  
**American Chemist**, 1 (1870)—7 (1877).  
**American Journal of Science (Silliman)**, 1 (1818)—[4] 7 (1900).  
**Analyst**, 1 (1876)—25 (1900).  
**Annalen de Physik (Gren, Gilbert, Poggendorff, Wiedemann)**, 1 (1799)—[2] 237 (1877).  
**Annalen der Chemie [Pharmacie] (Liebig)**, 1 (1832)—313 (1900).  
**Annales de chimie et de physique** [2], 40 (1829)—[7] 21 (1900), except [3] 38 and 39.  
**Annals of Philosophy**, 1 (1813)—[2] 12 (1826).  
**Archiv de Pharmacie**, 51 (1847)—238 (1900).  
**Berg- und hüttenmännische Zeitung**, 1 (1842)—59 (1900).  
**Berichte der deutschen chemischen Gesellschaft**, 1 (1868)—33 (1900).  
**Bulletin de la société chimique (Paris)**, [2] 1 (1858)—[3] 24 (1900).  
**Chemical Gazette**, 1 (1843)—17 (1859).  
**Chemical News**, 1 (1860)—82 (1900).  
**Chemiker Zeitung**, 3 (1879)—25 (1900), except volume 5.  
**Chemische Industrie**, 8 (1885)—15 (1892) and 21 (1898)—23 (1900).  
**Chemisches Annalen (Crell)**, 1 (1784)—13 (1802).  
**Chemisches Centralblatt [Pharmaceutisches]**, 1832-1900.  
**Chemisch-technisches Repertorium**, 1 (1862)—39 (1900), except 1879-81.  
**Chemist**, 1 (1840)—8 (1848).  
**Comptes rendus de l'Académie des sciences**, 1 (1835)—131 (1900).  
**Gazetta chimica italiana**, 1 (1871)—30, (1900).  
**Iron**, 1 (1872)—41 (1893).  
**Jahrbuch der Chemie (Meyer)**, 1891-1900.  
**Jahresbericht für chemische Technologie (Wagner)**, 1 (1855)—46 (1900).  
**Jahresbericht über die Fortschritte der Chemie**, 1847-1891.  
**Jahresbericht über die Fortschritte der physischen Wissenschaften**, 1 (1822)—28 (1849).  
**Journal of the American Chemical Society**, 1 (1879)—22 (1900).  
**Journal of Analytical and Applied Chemistry (Hart)**, 1 (1887)—7 (1893).  
**Journal of the Chemical Society (London)**, 1 (1841)—78 (1900).  
**Journal für Chemie (Schweigger)**, 1 (1811)—69 (1833).  
**Journal of the Franklin Institute**, 1 (1826)—143 (1897).  
**Journal of the Iron and Steel Institute**, 1874-1900.  
**Journal für praktische Chemie**, 1 (1834)—[2] 62 (1900).  
**Journal of the Society of Chemical Industry**, 1 (1882)—19 (1900).  
**Mittheilungen aus der technischen Gewerbe Museum, Wien**, 1891-1899.  
**Monatshefte für Chemie**, 1 (1880)—21 (1900).

## Viii BIBLIOGRAPHY OF ANALYTICAL CHEMISTRY OF MANGANESE

Moniteur scientifique. 1 (1857)—44 (1896).

Oesterreichische Zeitschrift für Berg- und Hüttenwesen. 1 (1853)—47 (1898).

Polytechnisches Centralblatt, 1 (1835)—40 (1875).

Polytechnisches Journal [Dingler]. 1 (1820)—314 (1899).

Proceedings of the Chemical Society (London). 3 (1887)—14 (1898). except Vol. 8.

Recueil des travaux chimique des Pays-Bas. 1 (1882)—19 (1900).

Répertoire de chimie pure et appliqué. 1 (1858)—5 (1863).

Revue de chimie industrielle, 1 (1890)—11 (1900).

School of Mines Quarterly. 1879—1900.

Stahl und Eisen, 1 (1881)—20 (1900).

Technisch-chemisches Jahrbuch, 15 (1892)—21 (1899).

Transactions of the American Institute of Mining Engineers, 1 (1871)—30 (1900).

Wiener Akademie Berichte. 1 (1848)—107 (1898).

Zeitschrift für analytische Chemie (Fresenius). 1 (1862)—39 (1900).

Zeitschrift für angewandte Chemie. 1888—1900.

Zeitschrift für anorganische Chemie. 1 (1892)—23 (1900).

Zeitschrift für physikalische Chemie. 1 (1887)—36 (1900).

•



# A BIBLIOGRAPHY OF THE ANALYTICAL CHEMISTRY OF MANGANESE.

1785-1900.

BY HENRY P. TALBOT AND JOHN W. BROWN.

---

- 1785: 1. HJELM, P. J. Versuche aus dem Braunstein den Brausteinkönig (Magnesium) zu erhalten, und denselben mit einigen Metallen zusammenzuschmelzen. (*Title from Crell's Ann.*)  
\* Königl. Vetensk. Acad. Nya. Handl., 1785; Crell's Ann., 1787, a, 451.  
Detection by the color produced on fusion with alkalies.
- 1786: 1. RINMANN, S. (*Title unknown.*)  
\* S. Chem. Ann., 3, 276; Crell's Ann., 1786, a, 361.  
Separation from iron.
- 1788: 1. PORCEL. Pour decouvrir dans un mine de fer les oxides (ou chaux) de zinc et de manganèse par le moyen de l'acide acetaux.  
J. de phys., 33, 436.  
Separation from zinc by treatment of the ignited oxides with acetic acid.
- 1792: 1. HERMBSTÄDT. Versuche und Bemerkungen über verschiedene Gegenstände.  
Crell's Ann., 1792, b, 315.  
Separation from iron by the aid of tartaric acid.
- 1796: 1. RICHTER. Etwas über die Reinigung des Braunsteins vom Eisen.  
Crell's Ann., 1796, b, 300.  
Separation from iron by the aid of tartrates.
- 1797: 1. KIRWAN. Ueber die Zerlegung und Probierung metallhaltiger Erze.  
Crell's Ann., 1797, b, 436.  
Separation from iron by nearly neutralizing the hydrochloric acid solution by caustic potash and boiling.

## 2 BIBLIOGRAPHY OF ANALYTICAL CHEMISTRY OF MANGANESE

- 1799: 1. VAUQUELIN. Analyse de quatre échantillons d'aciers.  
J. de Mines, 5, 15.  
Separation from iron by means of acid potassium carbonate.
- 1806: 1. BERZELIUS, J. Om Fettsyran.  
Afhandlingar i Fysik, Kemi och Mineralogi, 1806, 171; J. für Chem.  
(Gehlen). 2, 286.  
Separation from iron by means of benzoic and succinic acids.
- 1806: 2. JOHN, J. F. Beiträge zur chemischen Kenntniss des Mangans.  
J. für Chem. (Gehlen), 3, 452; Ann. Phil. (1813), 2, 172.  
Separation from iron by means of oxalates and succinates.
- 1811: 1. BUCHOLZ. (Title unknown.)  
\* J. für Chem. (Gehlen), 9, 673; Ann. Phil. (1813), 2, 343; Ann.  
chim. phys. (1), 79, 310; J. de Mines, 30, 301.  
Separation from iron by means of oxalates.
- 1812: 1. PFAPF, C. H. Ueber die Scheidung des Mangans vom Eisen, und das Verhältniss des Mangans gegen einige Reagentien.  
J. für Chem. (Schweigger), 4, 368.  
Comments on the methods of separation used by Vauquelin, Richter, Berzelius, and John.
- 1813: 1. HATCHETT. On the Method of Separating Iron from Manganese.  
Ann. Phil., 2, 343; J. für Chem. (Schweigger), 14, 352.  
Separation from iron by means of ammonia in slight excess in the presence of ammonium chloride.
- 1814: 1. DAVY, J. Ueber die Verbindungen des Halogens mit Mangan, Blei, Zink, Arsenik, Antimonium und Wismuth.  
J. für Chem. (Schweigger), 10, 510.  
Separation from iron by volatilization of ferric chloride.
- 1815: 1. JOHN, J. F. Vermischte Bemerkungen.  
J. für Chem. (Schweigger), 14, 399.  
Detection in plant ashes by the formation of metaphosphate.
- 1817: 1. GROTHUSS, T. Methode das Eisen vom Mangan zu scheiden.  
J. für Chem. (Schweigger), 20, 272; Ann. Phil., 13, 50.  
Separation from iron by means of potassium "anthrazothionate."
- 1819: 1. BRANDES, R. Chemische Untersuchungen der Manganerze.  
J. für Chem. (Schweigger), 26, 124.  
Use of Davy method to separate iron, and precipitation of manganese as carbonate. See 1814: 1.

- 1819: 2. FARADAY, M. (Title unknown.)  
 Quart. J. Sci., 6, 357.  
 Separation from iron.
- 1819: 3. PFAPP, C. H. Noch ein Wort über die Scheidung des Mangans vom Eisen nebst einiger Bemerkungen über Mangansalze und die Reactionen des Mangans.  
 J. für Chem. (Schweigger), 27, 91.  
 Comments on various methods for the separation from iron.
- 1820: 1. GAHN. Ueber das Lothrohr.  
 J. für Chem. (Schweigger), 29, 308.  
 Detection by means of blow-pipe beads.
- 1821: 1. HERSCHELL, J. F. W. Separation of Iron from other Metals.  
 Phil. Mag., 57, 393; Ann. Phil. (2), 3, 95; Ann. chim. phys. (2), 20, 304; J. für Chem. (Schweigger), 32, 452.  
 Separation in boiling solution by means of ammonium carbonate.
- 1821: 2. PFAPP, C. H. Ueber Fällung des Eisens und des Mangans durch Hydrothionsäure.  
 J. für Chem. (Schweigger), 33, 475.  
 Precipitation by means of sulphuretted hydrogen.
- 1824: 1. FROMMHERZ, C. Ueber die Mangansäure.  
 J. für Chem. (Schweigger), 41, 270.  
 Determination in manganic acid by the oxygen evolved on ignition.
- 1827: 1. DU MENIL. Ueber Scheidung des Mangans vom Eisen, wie auch des Kobalts vom Mangan.  
 J. für Chem. (Schweigger), 51, 225; Berzelius' Jsb., 8, 156.  
 Separation from iron by means of arsenic acid or oxalates stated to be valueless, separation from cobalt by means of oxalates and ammonia.
- 1827: 2. QUESNEVILLE, Jr. Sur un moyen analytique pour separer le fer du manganese.  
 J. de pharm., 12, 474; Ann. chim. phys. (2), 34, 198, Berzelius' Jsb., 7, 143.  
 Separation from iron by means of sulphates, succinates, and arsenates.
- 1827: 3. STROMEYER. Chemische Analyse einer neuen Abhandlung des Magnesits und eine neue sichere Methode das Mangan von der Talk- und Kalkerde zu scheiden.  
 Göttingsche Geleht. Anzeige, 1827, 1569, Ann. der Phys. (Pogg.) 11, 160; J. für Chem. (Schweigger), 21, 223; Mag. für Pharm. (Geiger) 22, 339, Berzelius' Jsb. (1829), 8, 186.  
 Separation from calcium and magnesium by means of chlorine

#### 4 BIBLIOGRAPHY OF ANALYTICAL CHEMISTRY OF MANGANESE

- 1829: 1. GAY-LUSSAC. Sur l'essai des oxides de manganèse du commerce.  
J. de pharm., 1828, Oct.; J. techn. Chem. (Erdmann), 4, 274.  
Determination of peroxide in pyrolusite by treatment with hydrochloric acid, passage of chlorine into milk of lime and titration with indigo.
- 1829: 2. LASSAIGNE. Note sur la purification de l'oxide de manganèse.  
Ann. chim. phys. (2), 40, 329; J. für Chem. (Schweigger), 56, 163;  
Dingl. pol. J., 33, 126; Arch. Pharm., 35, 262.  
Separation from iron by means of acid oxalates not found suitable for analytical purposes.
- 1829: 3. MARTINI. Ueber das arseniksaure Kali als Scheidungsmittel des Eisens vom Mangan.  
J. für Chem. (Schweigger), 56, 162.  
Separation from iron by means of potassium arsenate, and by succinic and benzoic acids.
- 1830: 1. BECQUEREL. Un procédé electro-chimique pour retirer le manganèse et le plomb des dissolutions dans lesquelles ils se trouvent.  
Mém. de l'Inst., 10, 286; Ann. chim. phys. (2), 43, 380.  
Separation from iron and zinc by electrolysis.
- 1830: 2. FUSS, W. E. Ueber Darstellung des reinen Manganoxyduls.  
J. für Chem. (Schweigger), 60, 346.  
Separation from iron by ammonia and precipitation as carbonate.
- 1831: 1. FUCHS, J. N. Beitrag zur Scheidung des Eisenoxydes vom Eisenoxydul und anderen Metalloxyden.  
J. für Chem. (Schweigger), 62, 192; Pharm. Centrbl., 1831, 461;  
Berzelius' Jsb. (1833), 12, 164.  
Separation from iron by means of calcium carbonate.
- 1831: 2. LIEBIG, J. Scheidung der Bittererde, des Manganoxyduls, des Kobalts und Nickels, des Eisenoxyduls vom Eisenoxyd, und des Bleioxyds vom Wismuthoxyd.  
Mag. der Pharm. (Geiger), 35, 111; Ann. chim. phys. (2), 48, 290;  
(2), 49, 111; Pharm. Centrbl., 1831, 747; Berzelius' Jsb. (1833), 12, 166.  
Finds method of Fuchs unreliable. See 1831: 1.
- 1831: 3. TURNER, E. Manganese: Mode of Ascertaining the Value of its Ores.  
\* J. Roy. Inst., 1, 293; Dingl. pol. J., 40, 212; J. Frank. Inst., 11, 356; Pharm. Centrbl., 1831, 304; \* Rep. Pat. Inv., 11, 224;

Phil. Mag., 9, 235; J. techn. Chem. (Erdmann), 10, 485; Ann. de Mines (3), 2, 321; Am. J. Sci., 21, 364; Ann. der Phys. (Pogg.), 14, 216; Arch. Pharm., 39, 35.

Treatment of ore with hydrochloric acid, passage of the chlorine into water and titration with a solution of ferrous sulphate to the disappearance of the odor of chlorine.

- 1832: 1. BERTHIER, P. Analyse de quelques minerais de manganèse d'espèces variées.

Ann. chim. phys. (2), 51, 79; Dingl. pol. J., 47, 104; Pharm. Centrbl., 1833, 120; J. techn. Chem. (Erdmann), 16, 379.

Determination of peroxide by liberation of nitrogen from ammonium chloride, by heating with sulphur, and by solution in oxalic acid and collecting the carbon dioxide formed.

- 1832: 2. DOBEREINER. Ueber das Verhalten der Magnesia zu einigen Metallsalzen.

J. für Chem. (Schweigger), 63, 482; Pharm. Centrbl., 1832, 109.

Separation from iron and cobalt by means of magnesia alba.

- 1832: 3. DUFLOS, A. Ueber Prüfung des Chlorkalks und des Brausteins.

J. für Chem. (Schweigger), 63, 346; Pharm. Centrbl., 1831, 800;

J. techn. Chem. (Erdmann), 13, 278.

Treatment with hydrochloric acid, oxidation of sulphurous acid by the chlorine generated, and precipitation of barium sulphate.

- 1832: 4. DUFLOS, A. Ueber Prüfung der Manganerze auf ihren Sauerstoffgehalt und über den Variocit von Ihlefeld.

J. für Chem. (Schweigger), 64, 81; Pharm. Centrbl., 1832, 105.

See 1832: 3.

- 1832: 5. KASTNER. Scheidung verschiedener Salzbasen.

N. Arch. für Chem. u. Meteorologie, 4, 433; Pharm. Centrbl., 1832, 208.

Separation from iron by means of ammonium salts of camphoric and suberic acids.

- 1832: 6. LIEBIG, J. Ueber Scheidung des Manganoxyduls von Eisenoxyde.

Ann. Chem. (Liebig), 1, 242; Pharm. Centrbl., 1832, 347.

Acknowledges correctness of Döbereiner's criticisms. See 1832: 2.

- 1833: 1. GÖBEL. Verhalten der Ameisensäure zu einiger Metalloxyden und Hyperoxyden.

J. für Chem. (Schweigger), 67, 76; Pharm. Centrbl., 1833, 271; Berzelius' Jsb. (1835), 14, 133.

Determination of peroxide by solution in hydrochloric and formic acids, and absorption of the carbon dioxide liberated.

## 6 BIBLIOGRAPHY OF ANALYTICAL CHEMISTRY OF MANGANESE

- 1833: 2. PLANIWA. Trennung des Manganoxyds und Eisenoxyds.  
\* Baumgartner's N. Ztschr., 2, 241; Pharm. Centrbl., 1833, 699.  
Separation from iron by fusion of the precipitate produced by ammonia with alkali and a nitrate.
- 1833: 3. ZENNECK. Pneumatische Methode der Untersuchung von Manganerzen auf ihren Superoxydgehalt, nebst Angabe von einigen demnach angestellten Prüfungen.  
J. techn. Chem. (Erdmann), 18, 75; Pharm. Centrbl., 1833, 959; Am. J. Sci., 29, 374.  
A comparison of gasometric methods, including Berthier's methods, expulsion of oxygen by heating the ore alone, by heating with sulphuric acid, and by heating with sugar; also the measurement of chlorine evolved on treatment with hydrochloric acid, and the measurement of the nitrogen evolved by heating with concentrated hydrochloric acid, with the addition of ammonia.
- 1834: 1. DEMARÇAY, H. Sur l'emploi des sels insolubles comme moyen de séparation dans l'analyse chimique.  
Ann. chim. phys. (2), 55, 398; Pharm. Centrbl., 1834, 660; Ann. Chem. (Liebig), 11, 241.  
Separation from iron by boiling a solution to which a few drops of ammonium carbonate solution in excess have been added.
- 1835: 1. GAY-LUSSAC. Nouvelle instruction sur la chlorométrie.  
Ann. chim. phys. (2), 60, 252; Pol. Centrbl., 1836, 286; Ann. Chem. (Liebig), 18, 47; Arch. Pharm., 58, 128.  
Determination of peroxide by solution in hydrochloric acid, passage of the chlorine into potassium hydroxide solution, and titration for the hypochlorite formed with arsenious acid.
- 1835: 2. PERSOZ, J. Sur l'ordre de tendance des oxides pour les acides et les applications qui en decoulent.  
Ann. chim. phys. (2), 58, 199; Pharm. Centrbl., 1835, 437.  
Separation from iron, nickel, and cobalt by means of mercuric oxide.
- 1836: 1. KRASKOWITZ. Manganreaction.  
Ann. der Phys. (Pogg.), 36, 565; Pharm. Centrbl., 1836, 175; Arch. Pharm., 58, 199.  
Detection by means of the red produced by hydrochloric acid when brought into contact with the mass after fusion with potassium carbonate.
- 1836: 2. THOMSON. On minerals containing columbium.  
Rec. Gen. Sci., 1836, 412; Pol. Centrbl., 1836, 788; Pharm. Centrbl., 1836, 475; Ann. des Mines (3), 11, 249; J. prakt. Chem., 9, 433; Ann. Chem. (Liebig), 19, 194; J. de pharm. (2), 22, 440; Dingl. pol. J., 61, 55; J. Frank. Inst., 22, 343; Arch. Pharm., 58, 68 and 132.

Detection by fusion with sodium carbonate. Determination by precipitation as carbonate and ignition to mangano-manganic oxide. Separation from iron by means of benzoates.

- 1836: 3. WITTSTEIN, G. C. Ueber die Prüfung des käuflichen Braunsteins auf seinen Gehalt an reinen Superoxyd.

Buchner's Repert. (2), 7, 169; Arch. Pharm., 58, 199

Comments on current methods for the valuation of manganese ores.

- 1837: 1. DÖBEREINER. (Title unknown.)

Berzelius' Jsb., 16, 159; Chemist, 1, 237.

Separation from cobalt through differences in solubility of the chlorides in ether.

- 1837: 2. EBELMEN. Nouveau moyen d'analyse les mineraux de manganèse.

Ann. des Mines (3), 12, 607; Pharm. Centrbl., 1838, 808; L'Inst. (1838), 6, 331; J. prakt. Chem., 14, 312; J. Frank Inst., 26, 332.

Determination of peroxide by solution in hydrochloric acid, passage of the chlorine evolved into a solution of sulphurous acid, and precipitation with barium chloride.

- 1837: 3. RICHTER, W. Trennung des Manganoxyduls von Zinkoxyd.

J. prakt. Chem., 9, 159; Pharm. Centrbl., 1837, 90; Ann. des Mines (3), 13, 460; Ann. Chem. (Liebig), 24, 309; Berzelius' Jsb., 17, 190.

Separation from zinc by ignition of the nitrates and treatment of the oxides with acetic acid.

- 1837: 4. SCHEERER, T. Ueber eine Methode das Kobaltoxyd, sowie das Nickeloxyd und Manganoxyd vom Eisenoxyd, von der Arsenik- und Arsenigen-säure zu trennen. (Title from Ann. der Phys. [Pogg].)

Nyt. Mag. Naturvidenskaberne, Physiographiske Forening Christiania, 1840, 46; Ann. der Phys. (Pogg.), 42, 104. Pharm. Centrbl., 1838, 7; J. prakt. Chem., 12, 354; Ann. des Mines, 13, 454; Dingl. pol. J., 68, 463, Arch. Pharm., 66, 202.

Separation from iron, arsenic and arsenious acids, by precipitation as basic sulphate or chloride.

- 1838: 1. GIESELER. Prüfung eines im Handel vorkommenden gepulverten Braunsteins auf seinen Gehalt an Manganhyperoxyd und an fremden Bestandtheilen.

Arch. Pharm., 65, 209.

Comments on Duflos' (1832: 3), Thomson's (1836: 2), and other methods for the determination of peroxide.



## 8 BIBLIOGRAPHY OF ANALYTICAL CHEMISTRY OF MANGANESE

- 1838: 2. WACKENRODER, H. Neue Methode zur Scheidung des Mangans vom Eisen, Nickel, Kobalt und Zink.  
Arch. Pharm., 66, 113; Pharm. Centrbl., 1838, 673 and 674; 1839, 193; Berzelius' Jsb. (1840), 19, 279; Jsb. chem., 1847, 975.  
Separation by means of sulphuretted hydrogen in acetic acid solution, and also by precipitation as sulphides and solution in dilute hydrochloric acid.
- 1839: 1. FIKENTSCHER, F. C. Prüfung der Braunsteinerze auf Sauerstoffgehalt.  
J. prakt. Chem., 17, 173; Dingl. pol. J., 73, 204.  
Determination of peroxide through loss of weight of strip of copper inserted in the hydrochloric acid during solution of the ore.
- 1839: 2. FUCHS, J. N. Eisenerzprobe (und Braunsteinprobe) auf nassem Wege.  
J. prakt. Chem., 17, 160; Pol. Centrbl., 1839, 665.  
See Fikentscher, 1839: 1.
- 1839: 3. W. Trennung von Kobalt und Mangan.  
Ann. Chem. (Liebig), 29, 217; Pharm. Centrbl., 1839, 384; Ann. des Mines (3), 15, 431; Arch. Pharm., 74, 57.  
Separation by means of silver nitrate and ammonia.
- 1841: 1. BERZELIUS. (Title unknown.)  
Berzelius' Jsb., 20, 189.  
Treatment with hydrofluoric acid to determine the state of oxidation of manganese in its minerals.
- 1841: 2. HENRY. (Title unknown.)  
\* Acad. de Med., 1839; Pharm. Centrbl., 1841, 923.  
Determination in mineral waters.
- 1841: 3. LIEBIG, J. Ueber Darstellung und Anwendung des Cyankaliums.  
Ann. Chem. (Liebig), 41, 293.  
Separation from cobalt by means of cyanide.
- 1841: 4. ULLGREN. (Title unknown.)  
Berzelius' Jsb., 21, 147; Chem. Gaz., 1, 13; Pharm. Centrbl., 1842, 254; Ann. Chem. (Liebig), 40, 266; Ann. des Mines (4), 2, 206.  
Separation from nickel and cobalt by precipitation with potassium hydroxide and hypochlorite, solution of the precipitate in hydrofluoric acid, and boiling with ammonia in excess.
- 1842: 1. LEA, H. C. Remarks upon the Examination of the Peroxide of Manganese.  
Am. J. Sci. (1), 42, 81.  
Tests to distinguish manganous from manganic salts.

- 1842: 2. LEVOL, A. Nouveau moyen d'essai du manganèse.  
*J. de pharm.* (3), 1, a, 210; *Chemist*, 3, 149; *Pol. Centrbl.*, 1842, 874; *Dingl. pol. J.*, 85, 299; *Ann. des Mines* (4), 2, 205; *J. prakt. Chem.*, 26, 151; *Chem. Gaz.*, 1, 329; *Ann. Chem. (Liebig)*, 44, 355; *Arch. Pharm.*, 81, 322.  
 Determination of peroxide by solution of the ore in hydrochloric acid and a ferrous salt, and titration for the excess of the latter with potassium chlorate, using indigo test paper.
- 1842: 3. OTTO, J. F. Unterscheidung des Zinks von Mangan in Auflösungen welche Ammoniaksalze enthalten.  
*Ann. Chem. (Liebig)*, 42, 347; *Pharm. Centrbl.*, 1842, 684; *Chem. Gaz.*, 1, 180; *Am. J. Sci.* (1), 47, 194; *Ann. des Mines* (4), 3, 569; *Berzelius' Jsb.*, 23, 242.  
 Separation by precipitation as sulphide and solution in acetic acid.
- 1842: 4. OTTO, J. F. Neue Methoden den Chlorkalk und den Braunstein zu prüfen.  
*Dingl. pol. J.*, 85, 296; *Pol. Centrbl.*, 1842, 876; *Chemist*, 3, 346; *J. de pharm.*, 1842, Mar.  
 Determination of peroxide by solution in hydrochloric acid and addition of ferrous sulphate, using potassium ferri-cyanide as an indicator.
- 1843: 1. BAUMANN, H. Prüfung des Braunsteins auf seinen Gehalt an Superoxyd.  
*Arch. Pharm.*, 84, 171; *Chem. Gaz.*, 1, 499.  
 Solution of ore in hydrochloric acid and passage of chlorine into a solution of silver nitrate (It is not evident how this procedure could possibly yield results of any value whatever.)
- 1843: 2. EBELMEN. Note sur le dosage du manganese.  
*Ann. chim. phys.* (3), 8, 508; *Ann. des Mines* (4), 4, 409; *Pharm. Centrbl.*, 1844, 400; *Chem. Gaz.*, 1843, 685; *Ann. Chem. (Liebig)*, 48, 369; *Arch. Pharm.*, 90, 178.  
 Determination as protoxide by reduction of the higher oxides by ignition in a current of hydrogen.
- 1843: 3. FRESENIUS, F., and WILL, H. Neue Verfahrungsweisen zur Bestimmung des Werthes der Pottasche und Soda, der Säuren und des Braunsteins.  
*Ann. Chem. (Liebig)*, 47, 87, 49, 137; *Dingl. pol. J.*, 90, 210; *Pol. Centrbl.*, 1843, b, 395; *Chem. Gaz.*, 1844, 52; *Pharm. Centrbl.*, 1843, 804; *Berzelius' Jsb.* (1845), 24, 261; *Buchner's Rep.*, 83, 240.  
 Determination of peroxide by solution with oxalates and absorption of the carbon dioxide

# 10 BIBLIOGRAPHY OF ANALYTICAL CHEMISTRY OF MANGANESE

- 1844: 1. ETTLING. Chemische Untersuchung des in der Nähe von Giessen vorkommenden Braunsteins.  
Ann. Chem. (Liebig), 43, 185; Berzelius' Jsb., 23, 243.  
Determination of peroxide by the procedure of Gay-Lussac (1835:1).
- 1845: 1. CLOEZ. Séparation de l'oxyde de cobalt de l'oxyde de manganèse.  
J. de pharm. (3), 7, 157; Pharm. Centrbl., 1845, 543; Berzelius' Jsb. (1847), 26, 277; Chem. Gaz., 3, 102.  
Separation by means of potassium polysulphide.
- 1845: 2. CRUM, W. Empfindliches Prüfungsmittel auf Mangan.  
Ann. Chem. (Liebig), 55, 219; Pharm. Centrbl., 1845, 894; Chem. Gaz., 3, 502; Am. J. Sci. (2), 1, 262; Ann. des Mines (4), 11, 496; Ann. der Phys. (Pogg.), 105, 294; J. de pharm. (3), 9, 221; Berzelius' Jsb. (1847), 26, 276.  
Oxidation to permanganic acid by means of lead peroxide in nitric acid solution.
- 1846: 1. BARRESWIL. Sur un nouveau mode de séparation du cobalt d'avec le manganèse.  
Ann. chim. phys. (3), 17, 53; C. R., 22, 421; Pharm. Centrbl., 1846, 415; Jsb. Chem., 1847, 974; Berzelius' Jsb., 27, 214; Pol. Centrbl., 1847, 642; 1848, 1295; Am. J. Sci. (2), 2, 260; Chem. Gaz., 1846, 159; J. de pharm. (3), 9, 189; Ann. des Mines (4), 11, 499; Dingl. pol. J., 100, 157; J. prakt. Chem., 38, 171.  
Separation by means of hydrogen sulphide in the presence of barium carbonate.
- 1846: 2. PHILLIPS, R. A New Test for Manganese.  
Chemist, 7, 152; Am. J. Sci. (2), 2, 259.  
Detection by means of the amethyst color given to solutions in which a piece of phosphorus is partly immersed, the whole being allowed to stand for some time in the dark.
- 1846: 3. ROWNEY, T. Analysis of the Bohemian Glass as found in the Combustion Tubes employed in Organic Analysis.  
Proc. Chem. Soc. (Lond.), 3, 300.  
Determination in glass.
- 1846: 4. VÖLKER, A. Ueber die rothe Färbung der Manganoxydulsalze.  
Ann. Chem. (Liebig), 59, 27; Pharm. Centrbl., 1846, 923; Chem. Gaz., 4, 397.  
Separation from cobalt by volatility of the manganous chloride in hydrogen.
- 1847: 1. BOBIERRE, A. (Title unknown.)  
\* Monit. Ind., 1847, No. 1190; Dingl. pol. J., 107, 448.  
Modification of the Gay-Lussac apparatus for the determination of peroxide.

- 1847: 2. LEVOL, A. Additions concernant une méthode d'essai de manganèse publiée dans ce recueil en Mars 1842  
 J. de pharm. (3), 10, 26; Berzelius' Jsb. (1848), 27, 213; J. prakt. Chem., 38, 341  
 Determination of the total amount of hydrochloric acid consumed by an ore, as well as the amount oxidized to chlorine. See 1842: 2.
- 1847: 3. ROSE, H. Ueber die Trennung des Nickels von Kobalt und die beider von anderen Metallen.  
 Ann. Chem. (Liebig), 64, 417; Jsb. Chem., 1847, 974. Ann. der Phys. (Pogg.), 71, 555.  
 Separation by means of sulphides and treatment with dilute hydrochloric acid. Comments on Barreswil (1846: 1) and Wackenroder (1838: 2) methods.
- 1847: 4. STRECKER. Ueber Barreswil's Trennungsmethode des Kobalts von Mangan.  
 Ann. Chem. (Liebig), 61, 219; Pharm. Centrbl., 1847, 367; Jsb. Chem., 1847, 974; Berzelius' Jsb. (1849), 28, 179; Pol. Centrbl., 1848, 1296; Chem. Gaz., 1847, 205; Am. J. Sci. (2), 4, 271.  
 Barreswil method regarded as inefficient. See 1846: 1.
- 1847: 5. SCHOENBEIN, C. F. Das Ozon als Reagens für Mangan.  
 Ann. der Phys. (Pogg.), 72, 466; Jsb. Chem., 1847, 952, Berzelius' Jsb. (1849), 28, 180.  
 Detection through the browning of solutions by ozone.
- 1847: 6. DE VRY. Bestimmung des Braunsteingehalts.  
 Ann. Chem. (Liebig), 61, 249; Pharm. Centrbl., 1847, 479.  
 Recommendation of Fresenius-Will method. (1843: 3.)
- 1849: 1. EBELMEN. Sur un nouveau mode d'emploi de l'hydrogen sulfuré dans l'analyse chimique.  
 Ann. chim. phys. (3), 25, 92; Chem. Centrbl., 1849, 169; Jsb. Chem., 1849, 592, Berzelius' Jsb. (1851), 30, 161; J. de pharm. (3), 15, 266; J. prakt. Chem., 46, 305; Ann. Chem. (Liebig), 72, 329; Chem. Gaz., 1849, 82.  
 Separation from cobalt, nickel and zinc by heating the oxides in an atmosphere of sulphuretted hydrogen and treatment of the sulphides with acetic or dilute hydrochloric acid.
- 1850: 1. DAVY, E. (Proceedings.)  
 Proc. Irish Acad., 4, 345.  
 Substance heated with flowers of sulphur, the mass extracted with water, and the manganese precipitated as ferrocyanide.
- 1851: 1. LAMING, R. On the Quantitative Estimation of Manganese.  
 Phil. Mag. (4), 1, 517; Dingl. pol. J., 121, 77.  
 Precipitation as carbonate; also a study of the stability of the carbonate.

- 1851: 2. MÜLLER, L. Prüfung des Braunsteins und Chlorkalks auf deren Gehalt an Mangansuperoxyd und wirksames Chlor.  
Ann. Chem. (Liebig), **80**, 98; Pol. Centrbl., **1852**, 312; Jsb. Chem., **1851**, 635; Chem. Centrbl., **1852**, 266; Chem. Gaz., **1852**, 75; Dingl. pol. J., **124**, 50; Arch. Pharm., **121**, 306.  
Determination of peroxide by passing chlorine evolved into stannous chloride solution, and titration of the excess of the latter with ferric chloride.
- 1851: 3. PERSONNE and LHERMITE. Faits pour servir à l'histoire des acides manganique et hypermanganique.  
J. de pharm. (3), **19**, 115; Arch. Pharm., **118**, 181.  
Determination of peroxide from loss of weight of strip of copper immersed during solution in sulphuric acid.
- 1851: 4. SCHABUS. Ueber die Anwendung des chromsauren Kalis zur Eisen-, Braunstein- und Chlorkalkprobe.  
Wien Akad. Ber., **6**, 406; J. prakt. Chem., **55**, 368; Dingl. pol. J., **125**, 278; Pol. Centrbl., **1852**, 571; Jsb. Chem., **1851**, 634; Ann. Chem. (Liebig), **80**, 360.  
Determination of peroxide by solution with ferrous sulphate and titration for the excess of the latter with potassium bichromate.
- 1852: 1. CHAPMAN. Detection of Manganese in Limestone Rocks.  
Phil. Mag., (4) **3**, 144; Chem. Centrbl., **1853**, 16; Chem. Gaz., **1852**, 60; Arch. Pharm., **124**, 168.  
Addition of borax necessary for the success of the usual fusion test.
- 1852: 2. GIBBS, W. Contributions to Analytical Chemistry.  
Am J. Sci. (2), **14**, 204; Chem. Gaz., **1852**, 368; Jsb. Chem., **1852**, 728; Chem. Centrbl., **1853**, 105; J. prakt. Chem., **58**, 241; Ann. Chem. (Liebig), **86**, 57 and 62; Ann. chim. phys. (3), **40**, 233; Arch. Pharm., **124**, 168.  
Separation from zinc, nickel, the alkaline earths and alkalis, by precipitation from neutral solutions by lead peroxide. Comments on Crum's method of detection. See 1845: 2.
- 1853: 1. BUNSEN, R. Ueber eine volumetrische Methode von sehr allgemeiner Anwendbarkeit.  
Ann. Chem. (Liebig), **86**, 283; Jsb. Chem., **1853**, 626; Chem. Centrbl., **1853**, 545; Ann. chim. phys., (3), **41**, 339.  
Determination by solution in hydrochloric acid, passage of the chlorine into potassium iodide solution, and titration of the iodine with sulphurous acid.
- 1853: 1a. DEVILLE, H. St. C. Nouvelle méthode generale d'analyse chimique.  
Ann. chim. phys. (3), **38**, 5; J. prakt. Chem., **60**, 9.  
Separation from alkalis and alkaline earths by ignition of the nitrates and treatment of the residue with dilute nitric acid.

- 1853: 2. FLAJOLOT. Sur la séparation de quelques oxydes métalliques.  
Ann. des Mines (5), 3, 641; Ann. chim. phys. (3), 39, 460; Jsb. Chem., 1853, 678, Chem. Centrbl., 1854, 156; C. R. 36, 1090; Chem. Gaz., 1853, 380, J. prakt. Chem., 59, 508, 61, 110.  
Separation from cobalt and zinc by precipitation with sodium carbonate in the presence of potassium cyanide.
- 1853: 3. HEIZEL. (Title unknown.)  
Ztschr. für Pharm., 2, 32; N. Rep. Pharm., 2, 271.  
Comments on Crum's test. See 1845: 2
- 1853: 4. HEMPEL, W. Mémoire sur l'emploi de l'acide oxalique dans les dosages à liqueurs titrées. Lusanne, 1853.  
Jsb. Chem., 1853, 629.  
Precipitation by means of sodium hypochlorite, solution of the precipitate in oxalic acid and titration for the excess.
- 1853: 5. KRIEGER, G. Zur volumetrische Bestimmung der Manganverbindungen.  
Ann. Chem. (Liebig), 87, 257, Jsb. Chem., 1853, 626; Chem. Gaz., 1853, 450, Ann. J. Sci., (2), 17, 126, J. prakt. Chem., 61, 472.  
See Bunsen, 1853: 1.
- 1853: 6. LÖWE, J. Ueber die Entdeckung kleiner Mengen von Mangan auf nassem Wege  
Dingl. pol. J., 130, 436  
Oxidation to permanganic acid by means of sodium hypochlorite.
- 1853: 7. LÖWENTHAL, J. Versuche über die Trennung des Zinns von anderen Metallen  
J. prakt. Chem., 60, 259.  
Separation from tin by means of sodium sulphate.
- 1853: 8. MORFIT, C., and BOOTH, J. C. On the Analysis of Cast Iron.  
Chem. Gaz., 1853, 388 and 411; J. prakt. Chem., 61, 102.  
Separation from iron by means of barium carbonate and precipitation as carbonate.
- 1853: 9. PARKINSON. (Title unknown.)  
Ann. Chem. (Liebig), 86, 62, Jsb. Chem., 1852, 730.  
Confirmation of Gibbs' results. See 1852: 2.
- 1853: 10. PRICE. On a New Method for the Determination of the Commercial Value of Oxide of Manganese.  
Chem. Gaz., 1853, 416; Pol. Centrbl., 1854, 111; Dingl. pol. J., 131, 34; J. prakt. Chem., 60, 471.  
Determination of peroxide by solution in hydrochloric acid, passage of the chlorine into a solution of arsenious acid, and titration for the excess of the latter with permanganate.

## 14 BIBLIOGRAPHY OF ANALYTICAL CHEMISTRY OF MANGANESE

- 1853: 11. RIVOT. (Title unknown.)  
Ann. des Mines, 6, 519; Pol. Centrbl., 1853, 821.  
Separation from cobalt and nickel.
- 1853: 12. SCHIEL, T. Separation of Manganese from Iron and Nickel.  
Am. J. Sci. (2), 15, 275; Chem. Centrbl., 1853, 528; Pol. Centrbl., 1853, 1512; J. prakt. Chem., 59, 184; Chem. Gaz., 1853, 413; Arch. Pharm., 115, 162.  
Precipitation by chlorine in the presence of sodium acetate.
- 1854: 1. DAVY, E. On Some New and Simple Methods of Detecting Manganese in Natural and Artificial Compounds and of Obtaining its Combinations for Economical Uses.  
Proc. Roy. Soc. (Lond)., 6, 385; Jsb. Chem., 1854, 734; Chem. Centrbl., 1854, 415; Chem. Gaz., 1854, 117; Phil. Mag. (4), 7, 222; J. prakt. Chem., 61, 448; Arch. Pharm., 130, 39.  
Detection by fusion with potassium hydroxide. Also by ignition with sulphur, oxidation to sulphate, solution, and precipitation with potassium ferrocyanide. See 1850: 1.
- 1854: 2. STRENG, A. Ueber eine allgemein Anwendbare Bestimmungsmethode auf maassanalytischem Wege.  
Ann. der Phys. (Pogg.), 92, 71; Dingl. pol. J., 133, 220; Jsb. Chem., 1854, 720; Chem. Centrbl., 1854, 683; Ann. Chem. (Liebig), 92, 414; Wagner's Jsb., 1, 20; Chem. Gaz., 1854, 271.  
Precipitation by means of hypochlorite, solution in stannous chloride, and titration for the excess of the latter with potassium bichromate, using iodo-starch indicator.
- 1855: 1. MOHR, F. Ueber Oxydations- und Reductionsanalysen.  
Ann. Chem. (Liebig), 93, 51; Dingl. pol. J., 135, 289; Wagner's Jsb., 1, 19.  
Criticism of Streng's procedure. See 1854: 2.
- 1855: 2. MÜLLER, L. Chemische Mittheilungen.  
Dingl. pol. J., 138, 116.  
Criticism of Streng. See 1854: 2.
- 1855: 3. FRESSENIUS, R. Ueber das Trocknen des Braunsteins zum Behuf seine Prüfung.  
Dingl. pol. J., 135, 277; Pol. Centrbl., 1855, 693 and 745; Wagner's Jsb., 1, 19.  
Discussion of the temperature which should be employed to dry pyrolusite before analysis.
- 1856: 1. GURLT, A. On the Compounds of Carbon and Iron and their Influence on the Production of Pig Iron.  
Chem. Gaz., 14, 260.  
Separation from iron by means of sodium bicarbonate. Precipitation by potassium hydroxide and ignition.



- 1856: 2. SCHREINER, E. Prüfung einiger Sorten käuflichen gepulverten Braunsteins.

Vierteljschr. für Pharm. (Wittstein), 5, 236; Dingl. pol. J., 140, 105; Pol. Centrbl., 1856, 955.

Addition of pyrolusite to ferrous sulphate solution until the iron is oxidized. (A crude method.)

- 1857: 1. BARRESWIL. Sur quelques procédés d'analyse applicable aux recherches mineralogiques.

C. R., 44, 677; Chem. Centrbl., 1857, 449; Jsb. Chem., 1857, 592; L'Inst., 25, 114; Chem. Gaz., 1857, 291; J. de pharm. (3), 31, 342; J. prakt. Chem., 71, 317; Arch. Pharm., 147, 46.

Detection by means of the violet color produced by sirupy phosphoric acid or salt of phosphorus.

- 1857: 2. BÖTTGER, R. Ueber das Verhalten verschiedenen Stoffe zu geschmolzenen reinen chlorsauren Kali.

Rep. für Pharm. (Buchner), 6, 247; J. phys. Ver. zu Frankfurt, 1856, 27; J. prakt. Chem., 70, 433; Chem. Centrbl., 1857, 635; Jsb. Chem., 1857, 136; Pol. Centrbl., 1857, 886; Pol. Notizbl., 12, 129; Arch. Pharm., 146, 288.

Detection by the color produced when the substance is brought into contact with fused potassium chlorate.

- 1857: 3. FIELD, F. On the Separation of Iron and Manganese.

Chem. Gaz., 1857, 374; Jsb. Chem., 1857, 592; Dingl. pol. J., 146, 315.

Separation by means of lead oxide. (PbO).

- 1857: 4. TERREIL, A. Note sur le dosage du manganèse, du nickel, du cobalt et du zinc.

C. R., 45, 652; J. de pharm. (3), 32, 383; Dingl. pol. J., 149, 265; Jsb. Chem., 1857, 593; L'Inst., 25, 366; Chem. Gaz., 1857, 452; J. prakt. Chem., 73, 481; Monit. scientif., 1, 607; Arch. Pharm., 151, 306.

Influence of ammonium salts on the precipitation as sulphide.

- 1858: 1. HEMPEL, C. W. Verhalten von Jod- und Bromkalium gegen die höheren Oxyde des Mangans.

Ann. Chem. (Liebig), 107, 101.

Determination of peroxide by directly heating the substance with potassium iodide and acid, and titration for the iodine liberated.

- 1858: 2. HENRY, T. H. On the Separation of Nickel and Cobalt from Manganese.

Phil. Mag. (4), 16, 197; Am. J. Sci. (1869), (2), 47, 130; Chem. Centrbl., 1859, 94; Jsb. Chem., 1858, 619; J. prakt. Chem., 76, 252.

Separation by means of phosphoric acid in the presence of an excess of ammonia and ammonium chloride.

- 1858: 3. ROSE, H. Ueber die Lösungen der Manganoxydsalze und über die Walter Crum'sche Reaction insbesondere.  
 \* Monatsber. Akad. Wiss. (Berlin), Nov., 1858; Rep. für Pharm., 8, 81.  
 See title.
- 1858: 4. SPILLER, J. On Some Remarkable Circumstances Tending to Disguise the Presence of Various Acids and Bases in Chemical Analysis.  
 J. Chem. Soc. (Lond.), 10, 114 and 117.  
 Effect of citrates and grape sugar upon the precipitation of manganese.
- 1859: 1. FIKENTSCHER, F. C. Prüfung der Braunsteinerze auf Sauerstoffgehalt.  
 J. prakt. Chem., 17, 173; Wagner's Jsb., 5, 65.  
 Determination of peroxide from the loss of weight suffered by a strip of copper immersed during the solution in hydrochloric acid.
- 1859: 2. NOLTÉ, G. Untersuchung des Braunsteins auf seinen Gehalt an Mangansuperoxyd.  
 Berg- u. hüttenm. Ztg., 18, 149; Ding. pol. J., 152, 136; Chem. Gaz., 1859, 288; Pol. Centrbl., 1859, 1079; Chem. Centrbl., 1859, 414; Wagner's Jsb., 5, 65; Arch. Pharm., 157, 187.  
 Comments and experiments upon procedure of Fikentscher. See 1859: 1.
- 1859: 3. VON KOBELL. Ueber die Anwendung des phosphorsauren Manganoxyds in der Titriranalyse, und der Phosphorsäure zur Mineralbestimmung.  
 J. prakt. Chem., 76, 415.  
 Detection by means of violet color produced by phosphoric acid.
- 1860: 1. FIELD, F. On the Separation of the Oxides of Nickel and Cobalt from Peroxide of Iron.  
 Chem. News, 1, 4.  
 Separation from iron by means of lead oxide (PbO).
- 1860: 2. GORGEU, A. Sur une combinaison de permanganate et de manganate de potasse.  
 C. R., 50, 610.  
 Precipitation by means of ammonium sulphide and ignition to manganomanganic oxide.
- 1860: 3. LENSSEN, E. Volumetrische Bestimmung des Manganoxyduls.  
 J. prakt. Chem., 80, 408; Jsb. Chem., 1860, 655; Chem. Centrbl. 1861, 78; Rep. chim. pure, 3, 139.  
 Volumetric determination by reduction of potassium ferricyanide and titration for the ferrocyanide with permanganate.

- 1860: 4. MACHNEA, M. Note sur la composition du permanganate de potasse.  
C. R., 51, 140.  
Determination by the method of Gay-Lussac. Also by the determination of the chlorine evolved, with the aid of arsenious or sulphurous acid.
- 1860: 5. ROSE, H. Chemisch-analytische Beiträge; Ueber die Bestimmung der Mengen von Metall in Schwefelverbindungen.  
Ann der Phys. (Pogg) 110, 122; Jsb Chem 1860, 644, Chem. Centrbl., 1860, 583; Ztschr. Chem., 1860, 557; Rep. chim. pure, 2, 391.  
Precipitation as sulphide and ignition in hydrogen.
- 1860: 6. ROSE, H. Chemisch-analytische Beiträge; Bestimmung des Mangans; Trennung des Manganoxyduls von Thonerde, Magnesia, Kalkerde und Eisenoxyd.  
Ann der Phys. (Pogg), 110, 301. Chem. News, 2, 266 and 302; J. prakt. Chem 84, 23 and 27; Rep. chim. pure, 2, 457; Arch. Pharm., 161, 57.  
Precipitation as sulphide and weighing as such. Separation from aluminium by means of ammonia in the presence of ammonium chloride, from magnesium and calcium by means of chlorine.
- 1860: 7. ROSE, H. Chemisch-analytische Beiträge; Trennung des Kobaltoxyds vom Nickeloxyd.  
Ann. der Phys. (Pogg), 110, 412, Jsb. Chem., 1860, 656, Ztschr. Chem., 1860, 622; Rep. chim. pure, 3, 91.  
Separation from nickel or zinc by means of lead peroxide in neutral solution. See Gibbs, 1852: 2.
- 1861: 1. FRESENIUS, R. Ueber den Einfluss von freiem Ammon und von Ammonsalzen auf die Fällung des Nickels, Kobalts, Zinks, Mangans, Eisens, und Urans durch Schwefelammonium.  
J. prakt. Chem., 82, 257. Chem. Centrbl., 1861, 525, Chem. News, 4, 150. Rep. chim. pure, 3, 66.  
Precipitation as sulphide.
- 1861: 2. KOLBE, H. Directe quantitative Bestimmung der Kohlensäure, kohlensaure Salze, und Braunsteinanalyse.  
Ann. Chem. (Liebig), 119, 120. Dingl. pol. J., 161, 373.  
Determination of peroxide by weighing the carbon dioxide evolved from oxalic acid on solution of pyrolusite.
- 1861: 3. MOHR, F. Bestimmung der verschiedenen Oxydationsstufen im Braunstein.  
Ann. Chem. (Liebig), 117, 382; Jsb. Chem., 1861, 850; Rep. chim. pure, 3, 254.  
Determination of the available oxygen in the original specimen and also after ignition.

- 1865: 2. GIBBS, W. On the Separation of Chromium from Aluminium, Iron, Manganese, Cobalt, Nickel, Zinc, and Magnesium; On the Employment of Acetate of Sodium for the Separation of Iron and Aluminium from other Bases; On the Separation of Manganese from Cobalt, Nickel, and Zinc.

Am. J. Sci. (2), 39, 58; Ztschr. anal. Chem., 3, 331; Chem. Centrbl., 1865, 405; Jsb. Chem., 1865, 712; J. prakt. Chem., 95, 356; Ztschr. Chem., 1865, 307; Dingl. pol. J., 178, 133; Chem. News, 11, 101 and 147; Bull. soc. chim. (2), 6, 126.

Separation from chromium by means of chlorine or lead peroxide in alkaline solution; separation from zinc, cobalt, and nickel by means of sulphuretted hydrogen in acetic acid solution.

- 1865: 3. HABICH, R. Maassanalytische Bestimmung des Mangans mit übermangansaurem Kali nach Guyard.

Ztschr. anal. Chem., 3, 474; Jsb. Chem., 1865, 713; Ztschr. Chem., 1865, 473; Chem. News, 12, 58.

Comments on Guyard method. See 1863: 2.

- 1865: 4. LUCKOW, C. Ueber Elektro-Metallanalyse.

Dingl. pol. J., 177, 231 and 296; 178, 42; Jsb. Chem., 1865, 686.

Precipitation of the peroxide by electrolysis.

- 1865: 5. RUBE, C. Ueber die Abscheidung des Mangans bei analytischen Arbeiten.

J. prakt. Chem., 94, 246; Chem. Centrbl., 1865, 830; Jsb. Chem., 1865, 711; Ztschr. Chem., 1865, 347; Ztschr. anal. Chem., 4, 421; Bull. soc. chim. (2), 4, 119.

Separation from iron and aluminum by means of mercuric oxide.

- 1865: 6. WARINGTON, R., Jr. On the Presence of Manganese in Oolite and Lias.

J. Chem. Soc. (Lond.), 3, 206.

Precipitation by means of chlorine, and ignition to mangano-manganic oxide.

- 1866: 1. BUNSEN, R. Flammenreactionen.

Ann. Chem. (Liebig), 138, 291; Phil. Mag. (4), 32, 104; Jsb. Chem., 1866, 782; Ztschr. anal. Chem., 5, 376.

Blowpipe reactions.

- 1866: 2. EGGERTZ, V. Ueber die Bestimmung des Mangangehaltes in Eisen und Eisenerzen.

\* Jern.-Kont. Ann., 1866, Heft 3; Berg- u. hüttenm. Ztg., 26, 187; Monit. scient. (1868), 10, 25; Jsb. Chem., 1868, 872; \* Schweiz. pol. Ztschr., 1867, 154; Ztschr. Chem., 1868, 507; Ztschr. anal. Chem., 7, 495; Bull. soc. chim. (2), 11, 238; Chem. News, 18, 232; Wagner's Jsb., 13, 12.

Separation from iron by the acetate method, precipitation by means of bromine, and drying and weighing of the precipitated peroxide.

- 1866: 3. FROHDE, A. Anwendung des unterschwefligsauren Natrons zur qualitativen und quantitativen Analyse und zur Darstellung von Präparaten.  
Arch Pharm, 177, 75; Ztschr anal Chem, 5, 396.  
Separation from cobalt and nickel by heating with sodium thiosulphate and removing the manganous sulphide by dilute acids.
- 1866: 4. REICHARDT, E. Ueber die Bestimmung und Scheidung von Manganoxydul, Eisenoxyd und-oxydul.  
Ztschr anal Chem, 5, 60; Arch Pharm., 179, 234; Vjschr. Pharm (Wittstein), 16, 394. Ztschr Chem, 1866, 592; Bull. soc. chim (2), 7, 495. Jsb Chem., 1866, 800.  
Separation from ferrous and ferric iron by the acetate method, precipitation as peroxide by means of sodium hypochlorite, and ignition to mangano-manganic oxide.
- 1866: 5. TERREIL, A. Séparation du cobalt et du nickel, et séparation du manganèse, du nickel et du cobalt.  
Bull. soc chim. (2), 5, 88; Dingl pol J., 180, 305. Chem. Centrbl., 1866, 149; Jsb Chem., 1866, 806, C R, 62, 139, L'Inst., 1866, 28; Ztschr. Chem., 9, 211; Ztschr. anal. Chem., 5, 113; J. prakt. Chem., 100, 52; Chem. News, 13, 133.  
Separation from cobalt and nickel by means of potassium permanganate or chlorine, in ammoniacal solution
- 1867: 1. BRAUN, C D. Zur Bestimmung des wirksamen Sauerstoffs in einigen Sauerstoffsäuren und Metalloxyden, eine Methode von vielfacher Anwendbarkeit.  
Ztschr anal Chem, 6, 66 and 73; Jsb Chem., 1867, 845. Chem Centrbl, 1867, 396, Ztschr Chem, 1867, 541, Chem-techn Rep., 6, b, 96.  
Detection by fusion with sodium pyrophosphate, or by heating the solution to be tested with phosphoric acid in the presence of lead peroxide. Determination by passing the chlorine evolved from the action of hydrochloric acid into a ferrous salt solution, and titration for the unoxidized iron
- 1867: 2. FORBES, D. Analysis of Blister Steel  
Chem News, 16, 105; Chem Centrbl, 1869, 37  
Separation from iron by means of barium carbonate, precipitation by means of ammonium sulphide, solution of the precipitate in sulphuric acid, re-precipitation as carbonate, and ignition to mangano-manganic oxide.
- 1867: 3. GIBBS, W. On the Estimation of Manganese as Pyrophosphate.  
Am J. Sci (2), 44, 216; Jsb. Chem., 1867, 845. Ztschr. Chem, 1867, 721. J. prakt Chem., 103, 395. Ztschr anal Chem, 7, 101; Bull. soc. chim (2) 9, 201. Chem News, 17, 195.  
See title.

- 1867: 4. TOSH, E. G. On the Analysis of Cast Iron.  
Chem. News, **16**, 168.  
Separation from iron by the acetate method, precipitation as sulphide, re-precipitation as the carbonate, and ignition to manganomanganic oxide.
- 1868: 1. BRAUN, C. D. Ueber das Verhalten der Manganoxysalze zu den Natronsalzen der Phosphorsäure bei Anwesenheit wirksamen Sauerstoffs.  
Ztschr. anal. Chem., **7**, 340; Jsb. Chem., **1868**, 227; Ztschr. Chem., **1869**, 306.  
Detection by heating with phosphoric acid and lead peroxide. See also 1867: 1.
- 1868: 2. JUETTE. Sur une méthode de dosage de l'acide tartarique et de l'acide malique, au moyen du fer, de l'aluminium, du manganèse, etc., et réciproquement.  
C. R., **66**, 417; Chem. News, **18**, 63; Bull. soc. chim. (2), **10**, 28.  
Volumetric estimation by titration with tartaric or malic acid in alkaline solution.
- 1868: 3. LUNGE, G. Ueber die analytischen Arbeiten in Sodafabriken.  
Dingl. pol. J., **186**, 205; Chem. Centrbl., **1868**, 1071.  
Determination of the peroxide by passing the chlorine evolved under the action of hydrochloric acid into a ferrous salt solution, and titration for the unoxidized iron.
- 1868: 4. TERREIL, A. Action des solutions salines sur les minéraux.  
C. R., **66**, 668; Ztschr. Chem., **11**, 337; Chem. News, **13**, 45.  
Separation from magnesium and zinc by means of ammonium sulphide in the presence of a large amount of ammonium salts.
- 1869: 1. CLASSEN, A. Ueber die Fällung und Bestimmung des Mangans durch Anwendung von Schwefelammonium.  
Ztschr. anal. Chem., **8**, 370; Chem. Centrbl., **1870**, 530; Jsb. Chem., **1869**, 887; Ztschr. Chem., **1870**, 285; Bull. soc. chim. (2), **14**, 44; Chem.-techn. Rep., **9**, b, 122.  
Some conditions under which precipitation as sulphide is incomplete.
- 1869: 2. DAMOUR, A. Notice sur la Jakobsite: nouvelle espèce minérale.  
C. R., **69**, 168; Jsb. Chem., **1869**, 891; L'Inst., **1869**, 243.  
Separation from iron by the acetate method and from magnesium by means of hydrogen peroxide.
- 1869: 3. GALETTI, M. Abänderung der Methoden zur volumetrischen Bestimmung des in Erzen enthaltenen Kupfers und Zinks mit einer Normallösung von Ferrocyankalium.  
Ztschr. anal. Chem., **8**, 137.  
Separation from zinc in alkaline solution by means of bromine.



- 1869 4. How. On the Non-Precipitation of Manganese by Sulphide of Ammonium in Presence of some Organic Ammoniacal Salts.  
Chem News 19, 137. Jsb Chem 1869, 887. Bull soc chim (2), 13, 48. Ztschr Chem 1869, 414. Ztschr anal Chem, 9, 382  
Influence of oxalic tartaric, and citric acids on the precipitation as sulphide.
- 1869 5. LUCKOW, C. Bestimmung des Kupfers in Mansfelder Schiefern.  
Ztschr anal Chem, 8, 24.  
Electrolytic separation from copper.
- 1869 6. MOHR, F. Zur Braunsteinanalyse.  
Ztschr anal Chem., 8, 314. Chem News, 22, 236  
Determination of manganese peroxide in pyrolusite. Comments on the Fresenius and Will method See 1843 3
- 1869 7. MUCK. Ueber die Fallbarkeit des Kobalts durch Schwefelwasserstoff und Reinigung kobalthaltiger Mangansalze.  
Ztschr. Chem., 12, 626; Bull. soc. chim. (2), 13, 334.  
Precipitation of cobalt from a solution containing manganous carbonate by means of hydrogen sulphide
- 1869 8. PRIOR, M. E. Ueber der Zusammensetzung der Mangan-carbonate.  
Ztschr anal Chem 8, 428. Jsb Chem, 1869, 886. Ztschr Chem, 1870, 274. Bull soc chim (2), 14, 104  
Determination by precipitation as carbonate Determination of manganese peroxide by passing the chlorine evolved from the action of hydrochloric acid into a ferrous salt solution and titrating for the unoxidized iron
- 1869 9. RENARD, A. De l'emploi du phosphate de soude pour l'élimination du manganèse dans l'analyse volumétrique des minerais de zinc.  
Bull soc chim (2), 11, 474. Chem Centrbl, 1870, 224. Ztschr. anal Chem, 8, 460 Chem News, 20, 35. Ztschr Chem, 1869, 662  
Separation from zinc by means of phosphates in ammoniacal solution
- 1869 10. SHERER, E., and RUMPF, G. On the Estimation of Peroxide of Manganese in Manganese Ores.  
Chem News, 20, 302. 21, 48. Jsb Chem, 1869, 889 Ztschr Chem., 1870, 478  
Comparison of the method of Fresenius and Will with the Bunsen method, also discussion of the iron method, and passage of chlorine into muck of lime and titration with arsenious acid



- 1869: 11. TESCHENMACHER, E. F., and SMITH, J. D. Zur Braunsteinprüfung.

Ztschr. anal. Chem., 8, 509; Ztschr. Chem., 13, 287; Jsb. Chem., 1869, 888.

Comparison of the results obtained by the method of Fresenius and Will and by the iron method.

- 1870: 1. FRESSENIUS, R. Zur Analyse von Körpern welche beim Erhitzen mit Salzsäure Chlor entwickeln.

Ztschr. anal. Chem., 9, 63; Jsb. Chem., 1870, 993; Ztschr. Chem. 1870, 479.

Criticisms of Bunsen's method for the determination of peroxide in pyrolusite.

- 1870: 2. GIBBS, W. On the Precipitation of Copper and Nickel by Alkaline Carbonates.

Am. J. Sci. (2), 44, 213; Chem. Centrbl., 1870, 62.

Precipitation of manganese by means of oxalic acid in presence of alcohol.

- 1870: 3. LEISON, W. G. On the Precipitation and Determination of the Metals of the Magnesium Group in the Form of Oxalates.

Am. J. Sci. (2), 50, 240; Chem. News, 22, 210; Chem. Centrbl., 1870, 706.

Precipitation as oxalate. Comments on Gibbs's method. See 1870:2.

- 1870: 4. PARKER, J. S. On the Estimation of Manganese in Spiegeleisen.

Chem. News, 22, 186; Dingl. pol. J., 199, 49; Chem. Centrbl. 1870, 725; Berg.- u. hüttenm. Ztg., 30, 55; Wagner's Jsb., 17, 13.

Influence of copper on the precipitation of manganese as hydrated peroxide.

- 1870: 5. PATTINSON, J. On the Estimation of Peroxide of Manganese in Manganese Ores.

Chem. News, 21, 267; Am. Chemist, 1870, 141; Ztschr. anal. Chem., 9, 509; Chem. Centrbl., 1870, 636; Jsb. Chem., 1870, 991; Bull. soc. chim. (2), 14, 347; Pol. Centrbl., 1871, 117 and 1568; Berg.- u. hüttenm. Ztg., 29, 347; Ztschr. Chem., 1870, 442; Chem.-techn. Rep. 10 a, 146; Dingl. pol. J., 197, 422; Wagner's Jsb., 16, 183. Refers to Fresenius and Will's, Sherer and Rumpf's, and Bunsen's methods.

- 1870: 6. PAUL, B. H. On the Testing of Manganese Ores.

Chem. News, 21, 16; Ztschr. anal. Chem., 9, 410.

Solution of the ore in oxalic acid and titration for the excess with potassium permanganate.

1870. 7. POLLACCI, E. Présence du manganèse dans le lait et dans le sang.  
J. de pharm (4), 11, 375. Chem. News, 21, 274. Quart J Sci., 7, 530.  
Qualitative test for manganese in milk and blood by means of lead peroxide in nitric acid solution of the ash.
1870. 8. ROWAN, T. On the Estimation of Manganese in Spiegeleisen and Ferro-manganese.  
Eng., 9, 455. Dingl pol J., 197, 330; Chem Centrbl., 1870, 592; Jsb. Chem., 1870, 993. Chem techn Rep., 9, b, 126. Wagner's Jsb., 16, 13; Berg- u. hüttenm Ztg., 29, 347.  
Separation from iron by the acetate method, precipitation by chlorine, and re-precipitation as carbonate.
1870. 9. SHERER, E. Assay of Manganese Ores.  
Chem. News, 21, 284. Ztschr. anal. Chem., 9, 513; Am. Chemist., 1, 144. Berg- u. hüttenm Ztg., 30, 312.  
Comments on Pattinson article. See 1870 : 5.
1870. 10. SHERER, E., and RUMPF, G. Ueber die verschiedenen Methoden der Braunsteinprüfung  
Ztschr. anal. Chem., 9, 46. Jsb. Chem., 1869, 889. Ztschr. Chem., 1870, 478. Chem. News, 22, 227. N. Jahrb. Pharm., 34, 211; Pol. Centrbl., 1870, 46.  
See 1869 : 10.
1870. 11. TALBOTT, J. H. A New Analytical Process  
Am. J. Sci. (2), 50, 244; Chem. Centrbl., 1870, 707; Jsb. Chem., 1871, 928; Chem. techn. Rep., 10, a, 147; Ber., 4, 279.  
Precipitation as sulphide and re-precipitation as phosphate
1870. 12. TISSANDIER, G. Méthodes d'analyse et composition des produits chimiques industrielles.  
Monit. scientif., 12, 277.  
Valuation of "manganese" of commerce. Formation of hypochlorite from chlorine evolved, and titration with arsenious acid
1871. 1. ALLEN, A. H. On the Employment of Potassium Ferricyanide as a Test for Cobalt, Nickel, and Manganese.  
Chem. News, 23, 290; Jsb. Chem., 1871, 930; Bull. soc. chim. (2), 16, 93. J. Chem. Soc. (Lond.), 24, 757. Ztschr. anal. Chem., 11, 79; Ztschr. Chem., 1871, 413.  
Detection by means of potassium ferricyanide.
1871. 2. CHATARD, T. M. Contribution to Chemistry from the Laboratory of the Lawrence Scientific School.  
Am. J. Sci. (3), 1, 419; Jsb. Chem., 1871, 928. Chem. Centrbl., 1871, 426; Chem. News, 24, 196; Ztschr. anal. Chem., 11, 308; J. Chem. Soc. (Lond.), 26, 531.  
Quantitative application of Crum's test. Ammonium oxalate employed to titrate for the permanganic acid. See 1845 : 2

## 26 BIBLIOGRAPHY OF ANALYTICAL CHEMISTRY OF MANGANESE

- 1871: 3. KÄMMERER, H. Ueber die Anwendung des Broms statt des Chlors zu analytischen Zwecken.  
Ber., 4, 218; Jsb. Chem., 1871, 866; Ztschr. Chem., 1871, 444;  
Ztschr. anal. Chem., 10, 464.  
Recommends use of bromine for manganese precipitations.
- 1871: 4. LUCK, E. Beiträge zur Braunsteinanalyse nach den Fresenius-Will'schen Verfahren.  
Ztschr. anal. Chem., 10, 310; Jsb. Chem., 1871, 929; J. Chem. Soc. (Lond.), 25, 264; Dingl. pol. J., 202, 305; Pol. Centrbl., 1871, 1568.  
Determination of the accuracy of the method.
- 1871: 5. ROWAN, T. On the Estimation of Manganese in Spiegel-eisen and Ferro-manganese.  
Chem. News, 23, 279; J. Chem. Soc. (Lond.), 24, 756; Am. Chemist, 2, 75.  
Precipitation of manganese as carbonate.
- 1871: 6. TAMM, H. On a New Method of Estimating Zinc.  
Chem. News, 24, 150; Jsb. Chem., 1871, 932; Ztschr. Chem., 14, 467; Bull. soc. chim. (2), 16, 261.  
Determination of manganese as phosphate.
- 1872: 1. ALLEN, A. H. Estimation of Manganese.  
Chem. News, 26, 81.  
Comments on Tamm's article. See 1871: 6.
- 1872: 2. BÖTTGER, R. Nachweisung von Spuren von Mangan.  
\*Jsb. phys. Ver. Frankfurt, 10, 388; Vierteljsb. prakt. Pharm., 21, 418; Jsb. Chem., 1872, 911; Ztschr. anal. Chem., 1872, 433; Chem. News, 24, 192; Chem.-techn. Rep., 10, b. 150; J. Frank. Inst., 93, 87.  
Detection of small amounts of manganese by contact of substance with fused potassium chlorate.
- 1872: 3. FRESSENIUS, R. Ueber die Bestimmung des Mangans auf gewichtsanalytischem Wege.  
Ztschr. anal. Chem., 11, 290 and 413; Jsb. Chem., 1872, 908; Am. Chemist, 3, 472; J. Chem. Soc. (Lond.), 26, 409.  
Determination as protosesquioxide after precipitation as manganous carbonate, hydroxide, hydrated peroxide (Guyard), or oxalate; as pyrophosphate (Gibbs) or as sulphide (Fresenius, Classen).
- 1872: 4. HORNER. The Spectra of Manganese in Blowpipe Beads.  
Chem. News, 25, 139; J. Chem. Soc. (Lond.), 25, 524.  
Detection by means of absorption spectra of blowpipe beads.

- 1872 5. KESSLER, F. Beitrage zur Analyse des Roheisens und Stahls.

Ztschr anal Chem., 11, 255; Monit scientif. 15, 826 Chem. News, 28, 158

Separation from iron by acetate and sulphate methods Precipitation of manganese by bromine, solution in antimonious chloride, and titration with potassium permanganate

- 1872 6 KESSLER, F Ueber die Bestimmung des Mangans in Roheisen, Stahl, und Stabeisen.

Ber 5, 605 Oester Ztschr Berg- u Huttenw 20, 405, Dingl. pol J 205, 332 and 439. Pol Centrbl 1872, 1608, Technologiste Dec 1872, Chem Centrbl. 1872, 617, Chem News, 27, 14, J Chem Soc (Lond) 25, 925, Chem-techn Rep, 11, b 199, Wagner's Jsb, 19, 11, Am Chemist, 4, 76, Iron 2, 326.

See 1872 5

- 1872 7. LECLERC, A. Dosage du manganèse dans les sols et dans les végétaux.

C R, 75, 1209; Chem News 26, 296 Jsb Chem, 1872, 910, Chem Centrbl, 1872, 88 Bull soc chim (2), 19, 177, Ztschr anal. Chem, 12, 308 Dingl pol J, 206, 166, J Chem. Soc (Lond), 26, 193, Chem-techn Rep, 12, a, 193; Am Chemist (1875), 5, 267 Arch Pharm, 202, 268

Oxidation to permanganic acid by means of lead peroxide, or red lead, and titration with mercurous nitrate

- 1872 8. PICHARD Dosage du manganèse dans les minerais de fer, les fontes, les aciers, par un procédé colorimétrique.

C R, 75, 1821, Dingl pol J, 207, 136 Jsb Chem, 1872, 909; Chem News, 27, 85, Bull soc chim (2), 19, 253, Ztschr anal Chem., 12, 308; J. Chem Soc. (Lond.), 26, 407; Chem-techn. Rep, 12, a, 195, Berg- u huttenm Ztg, 32, 91

Oxidation to permanganic acid by means of lead peroxide in nitric acid solution

- 1872 9. DE REZENDE. Note sur un procédé de séparation du fer et du manganèse.

Ann des Mines (7), 1, 418

Separation from iron by means of cupric oxide.

- 1872 10. TAMM, H. On an Improved Mode of Estimating Manganese

Chem News, 26, 37, Am Chemist, 3, 135 Jsb Chem, 1872, 910

Monit scientif, 14, 973, Bull soc chim (2), 19, 121

Precipitation with ammonium carbonate from solutions containing ammonium chloride Separation from iron by the succinate method and from zinc and nickel by ammonium carbonate,

- 1872: 11. TAMM, H. On the Metallurgy of Manganese, and the Docimastic Assaying of Manganese Ores.  
Chem. News, 26, 111; Am. Chemist, 3, 177; Pol. Centrbl., 1872, 1348.  
Dry assay with various fluxes.
- 1873: 1. BRÜNNER, A. Schnell durchführbare colorimetrische Probe auf Mangangehalt des Roheisens, Stahls, Eisens, und Erze.  
Oester. Ztschr. Berg- u. Hüttenw., 21, 341; Chem. Centrbl., 1873, 757; Bull. soc. chim. (2), 21, 278; J. Chem. Soc. (Lond.), 27, 604 and 816; Chem.-techn. Rep., 12, b, 196; Wagner's Jsb., 20, 10; Pol. Centrbl., 1873, 1367; Dingl. pol. J., 210, 278.  
Conversion to sodium manganate and comparison of solutions.
- 1873: 2. GIBBS, W. On the Estimation of Manganese as Pyrophosphate.  
Chem. News, 28, 51; Jsb. Chem., 1873, 934; J. Chem. Soc. (Lond.), 27, 92.  
Precipitation by means of salt of phosphorus. See 1867: 3.
- 1874: 1. KOPPMAYER, M. Ueber A. Brünner's colorimetrische Probe auf Mangangehalt des Stahls, Eisens, und der Erze.  
Dingl. pol. J., 211, 133; Jsb. Chem., 1874, 988; Chem. Centrbl., 1874, 138; J. Chem. Soc. (Lond.), 27, 1009; Pol. Centrbl., 1874, 395; Berg- u. hüttenm., Ztg., 33, 109.  
Regards Brünner's method as valueless. See 1873: 1.
- 1874: 2. MORRELL, T. T. Estimation of Manganese.  
Am. Chemist, 5, 213; Jsb. Chem. 1874, 988.  
Colorimetric method depending upon the liberation of iodine in solution, after precipitation by bromine.
- 1874: 3. PIESSE, C. H. The Estimation of Silicon, Graphite, Manganese, Aluminium, and Calcium in Pig Irons.  
Chem. News, 29, 110; Jsb. Chem., 1874, 986; Bull. soc. chim. (2), 22, 67; J. Chem. Soc. (Lond.), 27, 711.  
Separation from iron by the basic acetate method and precipitation by bromine.
- 1874: 4. PARRY, J. Estimation of Manganese in Spiegeleisen.  
Chem. News, 29, 86; Jsb. Chem., 1874, 987; Am. Chemist, 4, 434; J. Chem. Soc. (Lond.), 27, 712; Bull. soc. chim. (2), 22, 68.  
Adaptation of Fresenius-Will method, after solution in nitric acid and ignition of the residue left on evaporation.
- 1874: 5. POUCHET, A. G. Revue des méthodes d'analyse des produits industriels: Titrage et assai des manganèses.  
Monit. scientif., 16, 1139.  
Comments of Mohr (1855: 1), Fresenius-Will (1843: 3), and Bunsen (1853: 1) methods for the determination of peroxide; also of method involving oxidation of sulphurous acid by chlorine evolved, and precipitation of barium sulphate. Outlines of

methods for the determination of total acid consumed, and of manganese in "Weldon Mud."

- 1874: 6. WILLIS, A. Estimation of Manganese in Spiegeleisen.

Chem News, 29, 150; Jsb Chem., 1874, 987.

Comments on Piesse, 1874: 3.

- 1875: 1. BOUSSINGAULT. Études sur la transformation du fer en acier par la cémentation.

Ann chim phys. (5), 5, 184; Dingl pol J., 224, 80; Jsb. Chem. 1877, 1061; Chem. Centrbl., 1877, 376.

Separation from iron by basic acetate method, and precipitation by hypochlorite. Determination of small quantities by means of lead peroxide and titration with mercurous nitrate; also electrolytic deposition.

- 1875: 1a. BOLTON, H. C. Index to the Literature of Manganese, 1596-1874.

\* Annals Lyceum Nat. Hist. N. Y., Nov., 1875.

Compilation of journal literature on manganese and its compounds.

- 1875: 2. KERN, S. Estimation of Manganese in Spiegeleisen, Iron, and Steel.

Chem. News, 32, 100; Jsb Chem., 1875, 955. Ztschr anal. Chem., 16, 505. J Chem Soc (Lond.), 29, 110. Chem.-techn Rep., 14, 2, 278; Wagner's Jsb., 22, 19; Am. Chemist, 6, 192.

Precipitation as manganous hydroxide, reduction in hydrogen, separation of iron by magnet, and ignition to protoxide.

- 1875: 3. LUNGE, G. Ueber die neusten Fortschritte in der Soda- und Chlorkalk-Industrie in England.

Dingl. pol. J., 215, 157; Pol Centrbl., 1875, 853.

Determination in "Weldon Mud" by ferrous sulphate and permanganate.

- 1875: 4. MORRELL, T. T. Note on the Estimation of Manganese in Spiegeleisen.

Am Chemist, 6, 45. Jsb Chem., 1875, 954.

Separation from iron by the basic acetate method, precipitation by bromine, and colorimetric determination by the liberation of iodine (See 1874: 2.)

- 1875: 5. VOGEL, H. W. Ueber die Absorptionsspectren einiger Salze der Metalle der Eisengruppe und Anwendung in der Analyse.

Ber., 8, 1533. Dingl pol J., 219, 533.

Detection by means of absorption spectra of permanganic acid.

### 30 BIBLIOGRAPHY OF ANALYTICAL CHEMISTRY OF MANGANESE

- 1876: 1. CAMPANI, G. Il manganese nelle ceneri si manifesta facilmente sotto la forma di fosfato manganico.  
Gazz. chim. ital., 1876, 464; Jsb. Chem., 1876, 1000; Chem. News, 35, 75; J. Chem. Soc. (Lond.), 32, 223.  
Detection in plant ashes by the color of the residue after evaporation with nitric acid.
- 1876: 2. FRESSENIUS, R. Methode zur Analyse alkalischer Mineralwasser.  
Ztschr. anal. Chem., 15, 222 and 225.  
Determination in mineral water by precipitation as sulphide and ignition in hydrogen.
- 1876: 3. GALBRAITH, W. The Determination of Manganese in Spiegeleisen.  
Chem. News, 33, 47; Am. Chemist, 6, 462; Oester. Ztschr. Berg- u. Hüttenw., 25, 31; Jsb. Chem., 1876, 999; Dingl. pol. J., 221, 448; Ztschr. anal. Chem., 16, 506; J. Chem. Soc. (Lond.), 28, 750; Wagner's Jsb., 22, 18; Berg- u. hüttenm. Ztg., 35, 355; Chem.-techn. Rep., 15, 479.  
Solution in nitric acid, evaporation and ignition; solution of residue with ferrous ammonium sulphate and titration for the excess.
- 1876: 4. KERN, S. Estimation of Manganese in Cast Iron.  
Chem. News, 33, 90; J. Chem. Soc. (Lond.), 29, 962; Dingl. pol. J., 221, 188; Am. Chemist, 7, 76; Rev. univers. des Mines, 39, 199; Bull. soc. chim. (2), 26, 474.  
Precipitation of iron and manganese by potassium hydroxide, solution of manganese by addition of ammonium chloride, filtration, precipitation as sulphide, strong heating with sulphuric acid, and weighing as mangano-manganic oxide.
- 1876: 5. PETERS, S. On the Estimation of Manganese in Iron and Steel.  
Chem. News, 33, 35; Jsb. Chem., 1876, 999; Dingl. pol. J., 221, 486; J. Chem. Soc. (Lond.), 29, 750; Wagner's Jsb., 22, 19; Chem.-techn. Rep., 15, 480.  
Colorimetric method. Oxidation to permanganic acid by lead peroxide.
- 1876: 6. PHIPSON, T. L. Determination of Manganic Oxide.  
Chem. News, 34, 19 and 39.  
Determination of manganese peroxide in the presence of sesquioxide.
- 1877: 1. BOLTON, H. C. Schemes of Analysis Executed in the School of Mines, Columbia College.  
Am. Chemist, 7, 307.  
Determination as pyrophosphate (Gibbs' method, 1867: 3).
- 1877: 2. CHAPMAN, E. J. On Some Blow-pipe Reactions.  
Chem. News, 35, 13 and 26; J. Chem. Soc. (Lond.), 31, 489.  
Detection by means of sodium carbonate.



1877. 3. CLASSEN, A. Quantitative Bestimmung des Mangans durch Fällung als Manganoxalat  
 Ztschr. anal. Chem., 16, 315; J. Chem. Soc. (Lond.), 32, 804; Dingl. pol. J., 225, 515; Chem. Centrbl., 1877, 503; Chem.-techn. Rep., 16, 636  
 Precipitation as oxalate and weighing as protosesoquioxide
1877. 4. CLASSEN, A. Zur Trennung des Mangans von Kalk  
 Ztschr. anal. Chem., 16, 318; Jsb. Chem., 1877, 1055; Chem. Centrbl., 1877, 470; J. Chem. Soc. (Lond.), 32, 805; Dingl. pol. J., 225, 515; Chem.-techn. Rep., 16, 636  
 Separation by means of oxalic acid not practicable.
1877. 5. CLASSEN, A. Ueber die Abscheidung des Mangans als wasserfreies Sulfur  
 Ztschr. anal. Chem., 16, 319; Jsb. Chem., 1877, 1062; Chem. Centrbl., 1877, 470; J. Chem. Soc. (Lond.), 32, 514  
 Precipitation as sulphide in presence of potassium oxalate
1877. 6. CLASSEN, A. Ueber eine neue Methode zur Trennung des Eisens von Mangan, Kobalt, Nickel und Zink.  
 Ber., 10, 1316; Jsb. Chem., 1877, 1064 and 1066; Chem. Centrbl., 1877, 602; Ztschr. anal. Chem., 16, 471; Bull. soc. chim. (2), 30, 409  
 Separation from iron by means of neutral potassium oxalate and acetic acid.
1877. 7. CLASSEN, A. Quantitative Bestimmung von Mangan, Kobalt, Nickel und Zink durch Fällung als Oxalate  
 Ber., 10, 1315; J. Chem. Soc. (Lond.), 32, 924  
 See 1877. 3
1877. 8. DEBY. Determination of Manganese in Spiegel, Iron, and Steel at Terrenoire.  
 \* Report, 1877, 11, Berg- u. hüttenm. Ztg., 37, 391  
 Oxidation to permanganic acid by lead peroxide and titration with arsenious acid
1877. 9. FUNARO, A. Della separazione quantitativa del ferro e del manganese nei minerali ferro-manganici  
 Gazz. chim. ital., 7, 286; Jsb. Chem., 1877, 1064; Chem. Centrbl., 1877, 661; Ber., 10, 1483; J. Chem. Soc. (Lond.), 32, 805; Dingl. pol. J., 225, 610; Chem.-techn. Rep., 16, 635  
 Separation from iron by means of ammonium benzoate or succinate
1877. 10. HANNAY, J. B. Note on a New Manganese Reaction  
 J. Chem. Soc. (Lond.), 33, 269; Jsb. Chem., 1877, 1063; Chem. Centrbl., 1878, 41; Chem. News, 36, 212; Bull. soc. chim. (2), 30, 412; Ber., 10, 2052; Chem.-techn. Rep., 16, 637  
 Precipitation by potassium chlorate in nitric acid solution, and determination by gravimetric and volumetric methods.

## 32 BIBLIOGRAPHY OF ANALYTICAL CHEMISTRY OF MANGANESE

- 1877: 11. KERN, S. Quantitative Analysis of Certain Metals in Iron and Steel.

Chem. News, 35, 67; Jsb. Chem., 1877, 1057; J. Chem. Soc. (Lond.), 32, 647; Eng. Min. J., 24, 127.

Determination in chrome-iron alloys. Use of sodium hypochlorite for precipitation advised.

- 1877: 12. KERN, S. On the Estimation of Manganese in Spiegeleisen and Ferro-manganese.

Chem. News, 35, 247 and 270; Ber., 10, 975; Jsb. Chem., 1877, 1062; Chem. Centrbl., 1877, 457; Dingl. pol. J., 225, 392; Chem.-techn. Rep., 16, 635.

Determination in alloys by ignition of mixed oxides of iron and manganese in hydrogen, and then in chlorine, leaving a residue of protosesquioxide. Also direct ignition of the alloy with ammonium chloride.

- 1877: 13. KRÄMER, C. Zur Trennung des Mangans von Eisen.

Ztschr. anal. Chem., 16, 334; Jsb. Chem., 1877, 1063; J. Chem. Soc. (Lond.), 32, 805.

Separation from iron by the basic acetate method. See Stöckmann, 1877: 20.

- 1877: 14. MUNROE, C. E. The Estimation of Manganese as Pyrophosphate.

Am. Chemist, 7, 287; Jsb. Chem., 1877, 1061; Iron, 9, 555.

The influence of ammonia upon the determination as phosphate.

- 1877: 15. PARREÑO, A. G. Determination du manganèse métallique par la voie volumétrique.

Ann. chim. phys. (5), 11, 571; Jsb. Chem., 1877, 1062; Chem. Centrbl., 1877, 615; Am. J. Sci. (3), 14, 418; J. Chem. Soc. (Lond.), 32, 924; Pharm. Centrbl., 18, 396; Chem.-techn. Rep., 16, 636.

Ignition of mineral to mangano-manganic oxide, treatment with hydrochloric acid and determination of the iodine liberated from potassium iodide, by the chlorine evolved.

- 1877: 16. PERREY. (Title unknown.)

\* Bull. de Rouen, 1877, 104; Jsb. Chem., 1877, 1063; Chem. Centrbl., 1878, 15; Dingl. pol. J., 226, 194; Chem.-techn. Rep., 16, 640.

Comparison of Fresenius-Will (1843: 3), Hempel (1858: 1), Gay-Lussac (1829: 1), Mohr (1855: 1), and Bunsen (1853: 1) methods for analysis of pyrolusite.

- 177: 17. RICHE, M. A. Note sur la dosage du manganèse, du nickel, du zinc et du plomb.

C. R., 85, 226; Jsb. Chem., 1877, 1066; Chem. News, 36, 96; Ztschr. anal. Chem., 17, 216; Bull. soc. chim. (2), 29, 378; Dingl. pol. J., 239, 380; J. Chem. Soc. (Lond.), 32, 924; Eng. Min. J., 24, 222; Chem.-techn. Rep., 16, 637; Rev. univers. des mines, 2, 297; Chem. Ind., 7, 27.

Electrolytic determination.

- 177: 18. RILEY, E. On the Estimation of Manganese in Spiegel-eisen and Iron in Manganiferous Ores.

J. Iron Steel Inst., 1877, 2, 52; Chem. News, 35, 175; J. Chem. Soc. (Lond.), 32, 1; Chem. Centrbl., 1877, 376; Oester. Ztschr. Berg- u. Huttenw., 25, 424; Dingl. pol. J., 227, 493; Iron, 9, 617, 711, and 746; Jsb. Chem., 1877, 1061; Ber., 10, 911; Bull. soc. chim. (2), 29, 282; Berg- u. huttenm. Ztg., 36, 223; Wagner's Jsb., 23, 21; Chem.-techn. Rep., 16, 633.

Separation from iron by the acetate method, precipitation by bromine, and ignition, also determination by difference.

- 177: 19. ROSENTHAL, G. Ueber die Fällung des Mangans mit Wasserstoffsuperoxyd.

Dingl. pol. J., 225, 154; Jsb. Chem., 1877, 1027; Chem. Centrbl., 1877, 651; Chem. News, 36, 147; Ztschr. anal. Chem., 17, 364; J. Chem. Soc. (Lond.), 32, 923; Bull. soc. chim. (2), 32, 364; Berg- u. huttenm. Ztg., 36, 324; Chem.-techn. Rep., 16, 635.

Separation from iron by the acetate method, and precipitation by means of hydrogen peroxide.

- 177: 20. STOCKMANN, C. Ueber die Bestimmung von Mangan und Phosphor im Spiegeleisen.

Ztschr. anal. Chem., 16, 172; Jsb. Chem., 1877, 1063; Dingl. pol. J., 225, 108; J. Chem. Soc. (Lond.), 32, 648; Chem. News, 36, 275; Monit. scientif., 19, 1274.

Separation from iron by the acetate method. See 1877: 13.

- 178: 1. BOVG, G. Sur un bleu au manganèse.

Bull. soc. chim. (2), 29, 109; Jsb. Chem., 1878, 1129.

Detection with the aid of a flux of silica, metallic sodium, and calcium carbonate.

- 178: 2. DESHAYES, V. Dosage du manganèse dans les fers, fontes et aciers; dans les spiegels, ferro-manganèses et minerais.

Bull. soc. chim. (2), 29, 541; Jsb. Chem., 1878, 1062; Chem. News, 38, 70; J. Chem. Soc. (Lond.), 34, 808; Bull. soc. ind. minérale (2), 7, 103.

Oxidation to permanganic acid by lead peroxide, and titration with arsenious acid.

- 178: 3. MATZURKE, G. Zur Trennung von Eisen und Mangan.

Ztschr. anal. Chem., 17, 78; Jsb. Chem., 1878, 1061.

Separation from iron by acetate method. See Kramer, 1877: 13.

## 34 BIBLIOGRAPHY OF ANALYTICAL CHEMISTRY OF MANGANESE

- 1878: 4. MORAWSKI, T., and STINGL, J. Ueber eine maassanalytische Bestimmung des Mangans.  
J. prakt. Chem. (2), **18**, 96; Jsb. Chem., **1878**, 275; Chem. Centrbl., **1878**, 758; Chem. News, **38**, 297; J. Chem. Soc. (Lond.), **36**, 277; Ztschr. anal. Chem., **18**, 471; Ber., **11**, 1933; Bull. soc. chim. (2), **32**, 603; Chem.-techn. Rep., **17**, b, 241.  
Determination by potassium permanganate in slightly acid solution.
- 1878: 5. MORAWSKI, T., and STINGL, J. Zur Bunsen'schen Braensteinbestimmungsmethode.  
J. prakt. Chem. (2), **18**, 101; Chem. Centrbl., **1878**, 759; Jsb. Chem., **1878**, 275; Ztschr. anal. Chem., **18**, 471; Ber., **11**, 1933; J. Chem. Soc. (Lond.), **36**, 278.  
Modification of an apparatus for the Bunsen method for the analysis of pyrolusite.
- 1878: 6. MÜLLER, F. C. G. Untersuchungen über den Bessemerprocess.  
Ber., **11**, 552; Ztschr. Ver. d. Ing., **22**, 467.  
Separation from iron by the acetate method and precipitation by chlorine.
- 1878: 7. PROCHASKA, J. Der Siemens-Martinprocess im Südbahnwalzwerke im Graz.  
Oester. Ztschr. Berg- u. Huttenw., **26**, 116; Berg- u. hüttenm. Ztg., **37**, 147.  
Oxidation to permanganate acid by red lead and titration by ferrous sulphate.
- 1878: 8. RICHE, A. Mémoire sur le dosage du manganèse, du plomb du cuivre, du zinc et du nickel; et sur l'analyse des alliages de ces métaux.  
Ann. chim. phys. (5), **13**, 508; Berg- u. hüttenm. Ztg., **37**, 26; Jsb. Chem., **1878**, 1062; J. Chem. Soc. (Lond.), **34**, 750.  
Electrolytic determination.
- 1878: 9. WRIGHT, C. R. A., and LUFF, A. P. Researches on Some Points in Chemical Dynamics.  
J. Chem. Soc. (Lond.), **33**, 526.  
A study of the oxides of manganese with reference to the bearing of the results reached upon current analytical methods.
- 1879: 1. BEILSTEIN, F., and JAWEIN, L. Ueber eine directe Trennung des Mangans von Eisen.  
Ber., **12**, 1528; Iron, **14**, 587; Jsb. Chem., **1879**, 1045; Chem. News, **40**, 300; Ztschr. anal. Chem., **19**, 77; Chem. Ztg., **3**, 630; Bull. soc. chim. (2), **32**, 604; J. Chem. Soc. (Lond.), **38**, 61; Dingl. pol. J., **234**, 254; Wagner's Jsb., **26**, 320; Monit. scientif., **22**, 811;

- J. Am. Chem. Soc. **1**, 533. Berg- u. hüttenm. Ztg., **38**, 360. Am. Chem. J. **2**, 73. Arch. Pharm., **215**, 449. J. Iron Steel Inst., **1880**, 354.  
Separation from iron by iodine in cyanide solution; also by precipitation by potassium chlorate in nitric acid; precipitation as sulphide.
1879. 2. CARNOT, A. Sur l'emploi de l'hydrogène sulfuré par voie sèche dans les analyses.  
Bull. soc. chim. (2) **32**, 161; C. R. **89**, 167. Jsb. Chem., **1879**, 1024.  
Determination as sulphide, with use of Rose crucible. See 1860. 5.
1879. 3. CLASSEN, A. Zur Trennung des Mangans von Zink.  
Ztschr. anal. Chem., **18**, 194. Chem. Centrbl., **1879**, 166. J. Chem. Soc. (Lond.) **36**, 1055. Chem. Ztg., **3**, 253. Chem. News, **40**, 33. J. Am. Chem. Soc., **1**, 327.  
Criticism of Tamm procedure. See 1872: 10.
1879. 4. CLASSEN, A. Ueber eine neue quantitative analytische Methode von vielfacher Anwendbarkeit.  
Ztschr. anal. Chem., **18**, 379, 380, and 396. Chem. News, **40**, 33. Chem. Ztg., **3**, 676. Bull. soc. chim. (2), **35**, 91. J. Chem. Soc. (Lond.), **36**, 969.  
Separation from iron and aluminum with the aid of potassium oxalate.
1879. 5. CLASSEN, A. Ueber eine neue Methode zur Trennung des Eisenoxys und der Thonerde von Mangan.  
Ztschr. anal. Chem., **18**, 175. Chem. Centrbl., **1879**, 365. Jsb. Chem., **1879**, 1045. Bull. soc. chim. (2), **33**, 446. J. Chem. Soc. (Lond.), **36**, 1055. J. Am. Chem. Soc., **1**, 325.  
See 1879: 4.
1879. 6. KESSLER, F. Ueber die Bestimmung des Mangans, besonders in Eisen-Manganlegierungen.  
Ztschr. anal. Chem., **18**, 1. Iron, **13**, 643, 675, and 706. Jsb. Chem., **1879**, 1050. Chem. Centrbl., **1879**, 90. J. Chem. Soc. (Lond.), **36**, 341. Chem. Ztg., **3**, 30. J. Am. Chem. Soc., **1**, 83. Am. Chem. J., **1**, 361. J. Frank. Inst., **107**, 411. Dingl. pol. J., **232**, 91. J. Iron Steel Inst., **1880**, 353.  
Separation from iron by means of sodium sulphate, precipitation by bromine, solution of the peroxide by antimonious chloride, and titration with potassium permanganate.
1879. 7. LEDEBUR, A. Zur chemischen Untersuchung des Eisens und seiner Erze.  
Berg- u. hüttenm. Ztg., **38**, 47.  
Comparison of Kessler (1879. 6), Riley (1877: 18), Müller (1851: 2), the sulphide and indirect methods of determination.

- 1879: 8. MACKINTOSH, J. B. (Correspondence.)

School Mines Quart., 1, 127.

Separation from iron by the acetate method, and precipitation by bromine.

- 1879: 9. PATTINSON, J. On a New Volumetric Method of Determining Manganese in Manganiferous Iron Ores, Spiegeleisen, Steel, etc.

J. Iron Steel Inst., 1879, a, 209; b, 335; Rev. univers. des mines, 10, 135.

Precipitation by hypochlorite in the presence of ferric salts, solution by ferrous iron and titration of the excess.

- 1879: 10. PATTINSON, J. On a Method of Precipitating Manganese entirely as Dioxide and its Application to the Volumetric Determination of Manganese.

J. Chem. Soc. (Lond.), 35, 365; Chem. News, 39, 201; Jsb. Chem., 1879, 1047; Monit. scientif., 22, 465; Ztschr. anal. Chem., 19, 346; Ber., 12, 1025; J. Am. Chem. Soc., 1, 327; Iron, 13, 336; 14, 12; Wagner's Jsb., 26, 321; Dingl. pol. J., 234, 160; J. Anal. Chem., 1, 71.

See 1879: 9.

- 1879: 11. PICKERING, S. U. On the Reaction between Sodium Thiosulphate and Iodine: Estimation of Manganese Oxides and Potassium Bichromate.

J. Chem. Soc. (Lond.), 37, 128; Chem. News, 40, 261; Jsb. Chem., 1880, 1182; Chem. Centrbl., 1880, 103; Bull. soc. chim. (2), 36, 261; Dingl. pol. J., 236, 350.

Determination of peroxide in pyrolusite by the titration of iodine liberated by the chlorine evolved on solution in hydrochloric acid.

- 1879: 12. PELLITZ, W. Analyse des Zsadanyer Meteoriten.

Ztschr. anal. Chem., 18, 64.

Determination in meteorites.

- 1879: 13. RÖSSLER, C. Ueber eine neue Bestimmung des Mangans mit Anwendung des Volhard'schen Silbertitrirverfahrens.

Ber., 12, 925; Jsb. Chem., 1879, 1050; Chem. Centrbl., 1879, 427; J. Chem. Soc. (Lond.), 36, 746; Chem. News, 40, 169; Bull. soc. chim. (2), 33, 281; Wagner's Jsb., 25, 16; J. Am. Chem. Soc., 1, 329; Dingl. pol. J., 233, 86.

Precipitation with ammoniacal silver nitrate, filtration of the manganous-silver compound, and titration for the excess of the silver by the sulphocyanide procedure.

- 1879 14. VOLHARD, J. Zur Scheidung und Bestimmung des Mangans.  
 Ann Chem (Liebig), 198, 318, Jsb Chem, 1879, 1048. Chem. News, 40, 207, J. Chem. Soc (Lond), 38, 141, Ztschr anal. Chem., 20, 271 and 285, Ber, 12, 2175, Bull. soc chim (2), 34, 715, Berg- u hüttenm Ztg, 39, 150, J. Iron Steel Inst, 1880, 355  
 Volumetric determination by potassium permanganate; separation from iron and aluminum by mercuric or zinc oxide, precipitation by halogens or lead peroxide in neutral solution, determination as manganous sulphate and as manganic-manganic oxide.
- 1880 1. BOTTGER, R. Höchst empfindliche Reaction auf Mangan  
 \* Technische Blätter, \* Tagebl Natf Ver. Baden-Baden, 1879, 193; Chem Centrbl, 1880, 249; Jsb Chem, 1880, 1181; Oester. Ztschr. Berg- u. Hüttenw., 28, 416.  
 See 1872 2
- 1880 2. DELLFS, H. The Behaviour of Sulphuretted Hydrogen with the Salts of the Heavy Metals.  
 Chem. News, 41, 279; Jsb. Chem, 1880, 1144  
 Precipitation by sulphuretted hydrogen in the presence of organic acids.
- 1880 3. DROWN, T. M. and SHIMER, P. W. The Determination of Silicon and Titanium in Pig Iron and Steel.  
 Trans Am Inst Min Eng., 8, 514.  
 Separation from iron by heating the iron or steel in an atmosphere of chlorine.
- 1880 4. DUNSTON, W. R. The Analysis of Steel.  
 Pharm J Trans (3), 10, 594, Jsb. Chem, 1880, 1180.  
 Separation from iron by the acetate method, precipitation by bromine, and ignition to manganic-manganic oxide.
- 1880 5. HASWELL, A. E. Volhard's Titration des Mangans mit übermangansaures Kali.  
 Dingl pol J., 235, 387, Jsb Chem, 1880, 1181, Chem. Centrbl., 1880, 249, Chem Ztg, 4, 224, J. Iron Steel Inst, 1880, 743  
 Confirmation of Volhard's procedure. (1879 14)
- 1880 6. JEWETT, J. Influence of Acetic Acid on the Separation of Iron as a Basic Acetate from Manganese, Zinc, Cobalt, and Nickel.  
 Chem. News, 40, 273, J Chem Soc (Lond), 38, 280.  
 See title
- 1880 7. v JUPTNER, H. Volhard's Methode der Trennung und Bestimmung des Mangans.  
 Oester. Ztschr. Berg- u. Hüttenw., 28, 168.  
 Favorable comment upon the Volhard method. (1879: 14)



## 38 BIBLIOGRAPHY OF ANALYTICAL CHEMISTRY OF MANGANESE

- 1880: 8. JURISCH, K. Zur Prüfung des Weldon'schlammes.  
Chem. Ind., 1880, 193; Dingl. pol. J., 237, 312; Wagner's Jsb., 26, 324.  
Determination of peroxide in "Weldon Mud" and of total acid consumed on solution.
- 1880: 9. DE KONINCK, L. L. Bromlösung als Reagens.  
Ztschr. anal. Chem., 19, 468; Jsb. Chem., 1880, 1153.  
Merely refers to the use of bromine for precipitation.
- 1880: 10. LUCKOW, C. Ueber die Anwendung des elektrischen Stromes in der analytischen Chemie.  
Ztschr. anal. Chem., 19, 17; Chem. News, 41, 213; Jsb. Chem., 1880, 1140.  
Electrolytic precipitation.
- 1880: 11. LUNGE, G. Ueber die Zusammensetzung und Analyse des nach Weldon's Verfahren regenerirten Mangansuperoxydes.  
Dingl. pol. J., 235, 300; 236, 231 and 236; Chem. News, 41, 141 and 181; Jsb. Chem., 1880, 1183; J. Chem. Soc. (Lond.), 38, 528.  
Discussion as to the efficiency of the ferrous sulphate-permanganate method for the determination of manganese in "Weldon Mud."  
See 1880: 14 and 1881: 12.
- 1880: 12. PARRY, J., and TUCKER, A. E. The Application of the Spectroscope to the Analysis of Iron and Steel.  
J. Iron Steel Inst., 1880, a, 163.  
Detection of manganese.
- 1880: 13. PATTINSON, J. (Discussion.)  
Chem. News, 41, 179; Jsb. Chem., 1880, 1183.  
Precipitation is incomplete by means of chloride of lime except in the presence of ferric chloride. See 1880: 16.
- 1880: 14. POST, J. Ueber die Zusammensetzung und Analyse des nach Weldon's Verfahren regenerirten Mangansuperoxydes.  
Verh. Ver. Beförd. Gewerbfl. 58, 464; Dingl. pol. J., 236, 225 and 235; Wagner's Jsb., 26, 317.  
Criticism of method used by Lunge, 1880: 11. See also 1881: 12.
- 1880: 15. RÖSSLER, C. Ueber eine neue maassanalytische Bestimmungsmethode des Mangans und des Kobalts.  
Ann. Chem. (Liebig), 200, 323; Jsb. Chem., 1880, 1182; Chem. Centrbl., 1880, 250; Ztschr. anal. Chem., 19, 75; Chem. News, 41, 184; Chem. Ztg., 4, 86; J. Chem. Soc. (Lond.), 38, 347; Dingl. pol. J., 235, 391.  
Determination with the aid of silver and the Volhard silver titration.  
See 1879: 12.

- 1880: 16. WELDON. Volumetric Estimation of Manganese.

Chem. News, 41, 207; Jsb. Chem., 1880, 1183.

Precipitation by means of chloride of lime found to be complete.

See 1880: 13.

- 1880: 17. WRIGHT, C. R. A., and MENKE, A. E. Note on Manganese Dioxide.

J. Chem. Soc. (Lond.), 37, 22; Chem. News, 40, 261; Jsb. Chem., 1880, 316; Chem. Centrbl., 1880, 66; Chem. Ztg., 4, 86; Ber., 13, 427.

Composition of manganese peroxide prepared in different ways.

- 1880: 18. WRIGHT, C. R. A., and MENKE, A. E. Volumetric Determination of Manganese.

J. Chem. Soc. (Lond.), 37, 42.

Comment on Pattinson's method. See 1879: 9.

- 1880: 19. VELEY, V. H. On Some Higher Oxides of Manganese and their Hydrates.

Chem. News, 41, 291; 44, 241 and 301; J. Chem. Soc. (Lond.), 37, 581.

A study of the various oxides of manganese.

- 1880: 20. ZIMMERMANN, C. Zur Scheidung der Schwermetalle der Schwefelammoniumgruppe.

Ann. Chem. (Liebig), 199, 3 and 9; 200, 226; Chem. Centrbl. 1880, 40.

Separation from zinc with the use of ammonium sulphocyanate.

- 1881: 1. BEILSTEIN, F., and JAWEIN, L. Bestimmung und Trennung einiger Metalle. I. Directe Trennung des Mangans von Eisen.

\* Ztschr. rusk. chim. obsc., 13, 9; Chem. Centrbl., 1881, 251; J. Chem. Soc. (Lond.), 42, 97; Wagner's Jsb., 27, 358.

Separation from iron by precipitation with iodine from cyanide solution, and also by potassium chlorate in nitric acid solution.

- 1881: 2. CLASSEN, A. Electrolytische Bestimmungen und Trennungen.

Ber., 14, 2772; Dingl. pol. J., 242, 440; Jsb. Chem., 1881, 1151; Bull. soc. chim. (2), 37, 525; J. Chem. Soc. (Lond.), 42, 896; Wagner's Jsb., 28, 448; Ztschr. anal. Chem., 22, 417; School Mines Quart., 3, 302.

Separation from iron, alumina, and phosphoric acid by electrolysis in the presence of oxalates.

- 1881: 3. CLASSEN, A., and v. REIS, M. Electrolytische Bestimmungen und Trennungen.

Ber., 14, 1626 and 1630; Dingl. pol. J., 242, 441; Jsb. Chem., 1881, 1152; J. Chem. Soc. (Lond.), 40, 1081; Ztschr. anal. Chem., 21, 255; Bull. soc. chim. (2), 37, 184; Wagner's Jsb., 27, 356; Am. Chem. J., 4, 58.

Electrolytic separation from iron, and determination by electrolysis.

- 1881: 4. DELVAUX, G. Séparation de l'oxyde de nickel et l'oxyde de cobalt.

C. R., 92, 723; Jsb. Chem., 1881, 1188; Ztschr. anal. Chem., 21, 111. Separation from cobalt by sulphuretted hydrogen in acetic acid solution, and from nickel by oxidation on standing in the air.

- 1881: 5. DESHAYES, V. Revue métallurgique.

Bull. soc. chim. (2), 36, 121.

Comments on Ford's and colorimetric methods of determination in steels. See 1881: 8.

- 1881: 6. DONATH, E. Ueber eine volumetrische Bestimmung von Chrom und Mangan neben Eisenoxyd und Thonerde.

Ber., 14, 982; Chem. News, 43, 253; Jsb. Chem., 1881, 1184; Chem. Centrbl., 1881, 469; Ztschr. anal. Chem., 22, 245; Chem. Ztg., 5, 304; J. Chem. Soc. (Lond.), 40, 760; Bull. soc. chim. (2), 37, 92; Wagner's Jsb., 27, 355; Dingl. pol. J., 242, 391.

Determination by addition of a neutral solution of manganese to standard solution of permanganate until latter is colorless.

- 1881: 7. EMMERTON, F. A. Chemical Methods for Analysing Rail Steel.

Trans. Am. Inst. Min. Eng., 10, 203; Jsb. Chem., 1882, 1289; J. Iron Steel Inst., 1881, b, 653; Eng. Min. J., 32, 319; Dingl. pol. J., 246, 239.

Determination by the Volhard method. (1879: 14.)

- 1881: 8. FORD, S. A. Method for the Estimation of Manganese in Spiegels, Irons, and Steels.

Trans. Am. Inst. Min. Eng., 9, 397; Eng. Min. J., 32, 6.

Precipitation by means of potassium chlorate, re-solution in acid and final precipitation as manganese ammonium phosphate.

- 1881: 9. FORGUIGNON. Recherches sur la fonte malleable et sur le recuit des aciers.

Ann. chim. phys. (5), 23, 447.

Determination in steel by the Leclerc method. See 1872: 7.

- 1881: 10. ILES, M. W. Decomposition of Slags and Silicates.

Chem. News, 43, 78; J. Chem. Soc. (Lond.), 40, 645.

Volumetric method of determination through the formation of manganate by fusion with alkali hydroxide. (Unimportant.)

1881. 11. KENT, W. Manganese Determination in Steel.  
Trans. Am. Inst. Min. Eng. 10, 101; J. Iron Steel Inst., 1881, b, 655, School Mines Quart., 3, 51  
General discussion of methods. Results of twelve chemists upon the same sample.
1881. 12. LUNGE, G. Zur Orientirung über die Frage des "Weldon-schlammes."  
Dingl. pol. J., 242, 371.  
Reply to Post, 1880 14
1881. 13. LUNGE, G. Bericht an die Generalversammlung des Vereins deutschen Sodafabrikanten  
Chem. Ind., 4, 373. Dingl. pol. J., 243, 493. J. Chem. Soc. (Lond.), 42, 895. J. Soc. Chem. Ind., 1, 93  
Comments on Fresenius-Will (1843.3), Bunsen (1853.1), and iron methods for the determination of the peroxide
1881. 14. v. REIS, M. A. Ueber die Benutzung einiger oxalsäuren Salze in der Analyse.  
Ber., 14, 1178, Jsb. Chem., 1881, 1155  
Detection in the presence of phosphoric acid by the aid of oxalates.
1881. 15. SARNSTROM, C. G. Ueber Manganbestimmung durch Titriren mit Chamäleonlösung  
\* Jern-Kont. Ann., 1881, Heft 7. Berg- u. hüttenm. Ztg., 40, 425; Iron 19, 104. Jsb. Chem., 1881, 1188. Ztschr. anal. Chem., 22, 84. Chem. Ztg., 5, 895. Chem. News 47, 177. Wagner's Jsb., 27, 358. J. Iron Steel Inst. 1883, a, 417. Scientif. Am. Suppl., 1882, 5167  
Precipitation of iron and manganese by sodium bicarbonate, and titration with potassium permanganate in the presence of the precipitate.
1881. 16. TERREIL, A. Liqueur volumetrique pour le dosage des composés suroxygénés ou agissant comme corps oxydants  
Bull. soc. chim. (2), 35, 551. Chem. Centrbl., 1881, 569. Jsb. Chem., 1881, 1155  
Determination of peroxide with the aid of ferrous salts and permanganate.
1881. 17. TROILIUS, M. Chemical Methods for Analysing Rail Steel.  
Trans. Am. Inst. Min. Eng. 10, 173. Eng. Min. J., 32, 300. J. Iron Steel Inst., 1881, b, 654; School Mines Quart., 3, 52.  
Separation from iron by the acetate method, precipitation by bromine in ammoniacal solution, and ignition to mangano-manganic oxide

- 1881: 18. WILLIAMS, F. A. A Volumetric Estimation of Manganese in Pig Iron and Steel.

Trans. Am. Inst. Min. Eng., 10, 100; Jsb. Chem., 1882, 1288; Dingl. pol. J., 246, 241; J. Iron Steel Inst., 1881, b, 656; Iron, 18, 540; Wagner's Jsb., 28, 15.

Precipitation by means of potassium chlorate, solution in oxalic acid, and titration for the excess of the latter.

- 1882: 1. DE BOISBAUDRAN, L. Séparation du gallium.

C. R., 94, 1625; Jsb. Chem., 1882, 1296; Chem. News, 46, 3.

Nine methods for the separation from gallium.

- 1882: 2. CABOT, J. W. Chemical Methods for Analysing Rail Steel.

Trans. Am. Inst. Min. Eng., 10, 191.

Separation from iron by the acetate method, and precipitation by bromine.

- 1882: 3. DARTON, N. H. On the Estimation of and Separation of Manganese.

Scientif. Am. Supplem. 1882, 5168; Chem. Ind., 5, 201; Wagner's

Jsb., 28, 448; Rep. anal. Chem., 2, 216; J. Soc. Chem. Ind., 1, 468.

Determination of peroxide in pyrolusite by solution with potassium oxalate, absorption of carbon dioxide by barium hydroxide, and titration for the excess of the latter.

- 1882: 4. DEWEY, F. P. Chemical Methods for Analysing Rail Steel.

Trans. Am. Inst. Min. Eng., 10, 194.

Determination by Kent's method. See 1881: 11.

- 1882: 5. DIEHL, W. Zur maassanalytische Bestimmung der Hyperoxyde.

Dingl. pol. J., 246, 196; Chem. Ind., 6, 157; Ztschr. anal. Chem.

(1887), 26, 296; Jsb. Chem., 1882, 1290; 1883, 1567; Chem. Centrbl., 1883, 6; J. Chem. Soc. (Lond.), 44, 242; Ber., 16, 2319;

Wagner's Jsb., 29, 439; Rep. anal. Chem., 3, 231; J. Soc. Chem.

Ind., 3, 115; Chem.-techn. Rep., 22, 236.

Determination of peroxide by digestion with hydrochloric acid and potassium iodide, and direct titration with thiosulphate.

- 1882: 6. DUNN, J. D. Contributions to the History of Oxides of Manganese.

Chem. News, 45, 137; Jsb. Chem., 1882, 302.

A study of the oxides of manganese and their relation to the Guyard method. See 1863: 2.

- 1882: 7. GUYARD, A. Dosage du zinc à l'aide d'un nouveau réactif et séparation de ce métal d'avec les alcalis, la chaux, la magnésie, le manganèse, le cuivre, le nickel et le cobalt.

Monit. scientif. (3), 12, 778; Jsb. Chem., 1882, 1293.

Separation from zinc by ammonium sulphocarbonate.

8. HASWELL, A. E. Maassanalytische Bestimmung und Trennung der Metalle.

Rep. anal. Chem., 2, 243; J. Iron. Steel Inst., 1882, 743.

Determination by Volhard method. No details.

9. JEWETT, J. Influence of Acetic Acid on the Separation of Iron as a Basic Acetate from Manganese, Zinc, Cobalt, and Nickel.

Am. Chem. J., 1, 251; Ztschr. anal. Chem., 21, 262.

See title.

10. KEISER, E. H. The Electrolytic Separation of Manganese in Pig Iron and Steel.

Eng. Min. J., 33, 131.

See title.

11. LEDEBUR, A. Eine colorimetrische Manganbestimmung.

Berg- u. hüttenm. Ztg., 41, 417; Jsb. Chem., 1882, 1288; Chem. Centrbl., 1882, 733; Ztschr. anal. Chem., 22, 607; Ber., 15, 2926; Wagner's Jsb., 29, 15; Stahl u. Eisen, 2, 626; Rep. anal. Chem., 2, 346; J. Chem. Soc. (Lond.), 44, 242; J. Soc. Chem. Ind., 2, 249; Techn.-chem. Jahrb., 5, 11; Dingl. pol. J., 248, 215; Chem.-techn. Rep., 21, b, 211.

Oxidation by lead peroxide to permanganic acid and comparison with solutions of potassium permanganate.

12. LEFORT, J., and THIEBAULT, P. De l'influence de la gomme arabique dans certaines réactions chimiques.

J. de pharm. (5), 6, 169; Pharm. J. Trans. (3), 13, 301; Jsb. Chem., 1882, 1259.

Influence of gum arabic on the precipitation as sulphide.

13. LÖWE, J. Ueber den qualitativen Nachweis und quantitativen Bestimmung des Arsens—sowie einiger in geringer Menge in gediegenen Kupfer des Handels vorkommenden Metalle.

Ztschr. anal. Chem., 21, 516.

Separation in the analysis of commercial copper.

14. MILLS, E. J., and BECKET, J. H. Researches on Chemical Equivalence.

Phil. Mag. (5), 13, 170.

Separation from nickel.

15. TAMM, A. Die üblichsten Eisenanalysen. (*Title from Chem. Centrbl.*)

\* Jern.-Kont. Ann., 1882, 123; Chem. Centrbl., 1882, 766; Jsb. Chem., 1882, 1288; Berg- u. hüttenm. Ztg., 41, 448.

Comparison of methods of determination.

- 1882: 16. TROILIUS, M. Bestämning af mangan i jern.

Jern.-Kont. Ann., 1882, 526; Berg- u. hüttenm. Ztg., 42, 255; Jsb. Chem., 1883, 1568 and 1674; Ber., 16, 1690; Wagner's Jsb., 29, 19; Rep. anal. Chem., 3, 189; J. Soc. Chem. Ind., 2, 428; Dingl. pol. J., 250, 417.

Precipitation by means of potassium chlorate, solution and separation of iron, re-precipitation by bromine, and weighing as proto-sesquioxide.

- 1882: 17. WAGNER, A. Ueber das Verhalten von Braunstein und Chlorkalk beim Glühen mit Chromoxyd und kohlensaurem Natron unter Ausschluss der Luft.

Ztschr. anal. Chem., 21, 493; Chem. News, 45, 80.

Determination of peroxide from the amount of chromate formed during the heating.

- 1883: 1. GOETZ. Die Bestimmung des Mangans in Eisen.

Dingl. pol. J., 248, 215.

Colorimetric determination by oxidation to permanganic acid by means of lead peroxide.

- 1883: 2. GUYARD, A. Recherche qualitative du manganèse dans le zinc de commerce, les cendrés de zinc et les calamines,—et recherches du bismuth dans le plomb commercial, au moyen de l'électrolyse.

C. R., 97, 673; Bull. soc. chim. (2), 40, 420; Jsb. Chem., 1883, 1514; Ber., 16, 2691; Chem. News, 48, 193; J. Chem. Soc. (Lond.) 46, 368 and 640; Chem. Ztg., 7, 1611; Rep. anal. Chem., 3, 379; Berg- u. hüttenm. Ztg., 42, 587.

Permanganic acid formed by electrolysis.

- 1883: 3. HARVEY, J. W. C. New Process for the Rapid Volumetric Estimation of Binoxide of Manganese.

Chem. News. 47, 2; Jsb. Chem., 1883, 1566; Chem. Centrbl., 1883, 199; J. Chem. Soc. (Lond.), 44, 513; Ztschr. anal. Chem., 23, 60; Ber., 16, 262; Chem. Ztg., 7, 141; Chem. Ind., 6, 82; Chem.-techn. Rep., 22, 236; Wagner's Jsb., 29, 437; Dingl. pol. J., 248, 303.

Determination of peroxide by solution in an excess of stannous chloride, addition of ferric chloride, and titration for the ferrous chloride formed.

- 1883: 4. HAMPE, W. Zwei neue maassanalytische Manganbestimmungsmethoden.

Chem. Ztg., 7, 1103; Jsb. Chem., 1883, 1565; Ber., 16, 2531; Stahl. u. Eisen, 3, 638; Wagner's Jsb., 30, 141; Berg- u. hüttenm. Ztg., 42, 536; Ztschr. anal. Chem. (1885), 24, 422; Techn.-chem. Jahrb., 6, 27.



Precipitation by means of potassium chlorate, solution by ferrous-ammonium sulphate, and titration for the excess of the latter. Evaporation of nitric-acid solution, heating of residue with phosphoric acid, and titration of the phosphate formed with a solution of ferrous sulphate.

- 183: 5. HEMPEL, C. W. Zur maassanalytischen Bestimmung der Hyperoxyde.

Dingl pol J., 247, 144.

Criticism of Diehl's article. See 1882: 5.

- 183: 6. v. JUPTNER, H. Das übermangansaure Kali als Titirflüssigkeit.

Oester Ztschr Berg- u Hüttenw., 31, 502.

Comments on Volhard method (1879: 14)

- 183: 7. KERL, B. (Title unknown.)

Dingl pol J., 250, 416.

Confirmation of Sarnström method See 1881: 15.

- 183: 8. KNOP, W. Zur Analyse der Silicate.

Ber königl. Sach. Ges. Wiss (math.-phys Classe), 1882, 35; Ztschr. anal. Chem., 22, 558

Determination in silicates. Brief reference only.

- 183: 9. MACKINTOSH, B. The Volumetric Determination of Manganese.

Trans Am Inst Min Eng., 12, 79. Chem News, 48, 176; Am. Chem J., 5, 290. Iron, 22, 464. Jsb. Chem., 1883, 1569; J. Iron Steel Inst., 1883, b. 761; J. Chem. Soc (Lond.), 46, 220, Ber., 16, 2939; Berg- u. hüttenm. Ztg., 43, 302.

Precipitation by potassium chlorate Williams method. See 1881: 18.

- 183: 10. MEINEKE, C. Titrirung des Mangans durch übermangansaures Kali.

Rep. anal. Chem., 3, 337; Jsb. Chem., 1883, 1567; Ztschr. anal. Chem. (1885), 24, 430. Ber., 16, 3074. Wagner's Jsb., 29, 437; Berg- u. hüttenm. Ztg., 43, 23; Chem. Ztg., 7, 1609.

Separation from iron by zinc oxide, addition of the solution to an excess of permanganate, and titration for the excess with antimonious chloride

- 183: 11. MEINEKE, C. See 1883: 10

- 183: 12. ORLOWSKI, A. Ersetzung des Schwefelwasserstoffs bei dem systematischen Gang der qualitativen chemischen Analyse durch unterschwefligsaures Ammon.

Ztschr. anal. Chem., 22, 364

Detection of manganese

- 1883: 13. RAIMOND, E. Nouvelle méthode volumétrique de dosage du manganèse dans les aciers, fontes, ferro-manganèses, etc.

Rev. univers. des mines, 13, 460; \* Armengaud. Publ. Ind., 1883, 189; Jsb. Chem., 1883, 1673; Chem. Centrbl., 1884, 156; Chem. News, 48, 23; Chem. Ztg., 8, 344; Wagner's Jsb., 29, 18; J. Iron Steel Inst., 1883, b, 783; Chem.-techn. Rep., 23, a, 236; Rep. anal. Chem., 4, 137; Berg- u. hüttenm. Ztg., 43, 166; J. Chem. Soc. (Lond.), 48, 840; Dingl. pol. J., 250, 416.

Precipitation by means of potassium chlorate, and use of ferrous sulphate.

- 1883: 14. SÄRNSTRÖM, C. G. Ueber volumetrische Manganbestimmung im Eisen.

Berg- u. hüttenm. Ztg., 42, 436; Wagner's Jsb., 29, 19; Dingl. pol. J., 250, 436.

Comments on Schoeffel and Donath method of determination. See 1883: 17.

- 1883: 15. SÄRNSTRÖM, C. G. Tillägg till uppsat sen om manganprof medelst titrering.

Jern.-Kont. Ann., 1883, 400; Stahl u. Eisen, 4, 127; Wagner's Jsb., 30, 23.

See 1881: 15.

- 1883: 16. SCHMITT. Einführung einheitlicher Untersuchungsmethoden bei Manganbestimmungen in Eisen.

Stahl u. Eisen, 3, 487; Wagner's Jsb., 29, 18; Oester. Ztschr. Berg- u. Hüttenw., 32, 164.

Request for the appointment of a commission to propose uniform methods for the determination of manganese.

- 1883: 17. SCHOEFFEL, R., and DONATH, E. Ueber eine neue Methode der volumetrischen Bestimmung des Mangans, insbesondere in Eisen und Stahl.

Oester. Ztschr. Berg- u. Hüttenw., 31, 229; Jsb. Chem., 1883, 1567; Chem. Centrbl., 1883, 332; Dingl. pol. J., 248, 421; Chem. Ztg., 7, 587; Ztschr. anal. Chem. (1885), 24, 427; Ber., 16, 1690; Wagner's Jsb., 29, 15; Stahl. u. Eisen, 3, 374; J. Iron Steel Inst., 1883, a, 381; Rep. anal. Chem., 3, 207; Berg- u. hüttenm. Ztg., 42, 231; Pharm. Runds, 1883, 352; Chem.-techn. Rep., 22, b, 235.

Volumetric determination by the addition of the manganese solution to alkaline permanganate solution.

- 1883: 18. SCHUCHT. Zur Elektrolyse.

Ztschr. anal. Chem., 22, 493; Jsb. Chem., 1883, 1512; Dingl. pol. J., 254, 298.

Electrolytic precipitation.

- 1883: 19. STONE, G. C. The Determination of Manganese in Spiegel.  
 Trans. Am Inst Min Eng., 11, 323. Eng Min J., 35, 318; Iron, 22, 378; J. Iron Steel Inst., 1883, a, 366, Dingl pol J., 250, 416, Techn.-chem Jahrb., 6, 27.  
 Precipitation by means of potassium chlorate, solution in oxalic acid, and titration with permanganate. Doubt as to the composition of the precipitate produced by the chlorate.
- 1883: 20. STONE, G. C. The Volumetric Determination of Manganese.  
 Chem News, 48, 273. Jsb Chem., 1883, 1569. J Chem Soc (Lond.), 46, 490. Wagner's Jsb., 29, 19.  
 Reply to Mackintosh 1883 9.
- 1883: 21. TROILIUS, M. The Determination of Manganese in Spiegel, Ferro-manganese, Steel, etc.  
 Trans Am Inst Min Eng., 12, 73. J Iron Steel Inst., 1883, b, 761; Iron, 22, 397. Jern-Kont Ann., 1883, 366. Berg- u huttenm. Ztg., 43, 284; Jsb. Chem., 1884, 1599; Chem Centrbl., 1884, 716; Ber., 17, 386, Ref., J Chem Soc (Lond.), 48, 597, Stahl u Eisen, 4, 126. Wagner's Jsb., 30, 18. J. Soc Chem Ind., 3, 523; 4, 137.  
 Use of potassium bichromate in connection with the Williams method of determination. See 1881, 18.
- 1883: 22. WOLFF, N. Ueber die Anwendung eines mit Bromdämpfen geschwängerten Luftstromes zur Fällung des Mangans.  
 Ztschr. anal. Chem., 22, 520; Jsb. Chem., 1883, 1566; Chem. Centrbl., 1884, 156. J Chem Soc (Lond.), 46, 640. Ber., 16, 3075; Chem. News, 49, 201; Wagner's Jsb., 29, 438; Rep. anal Chem., 3, 364; J. Am. Chem. Soc., 5, 244.  
 Precipitation by bromine in ammoniacal solution.
- 1883: 23. ZULKOWSKY, K. Zur Bestimmung des Mangans in Eisen-erzen. (*Title from Dingl. pol. J.*)  
 \* Ber oester chem Ges., 1883, 3; Jsb Chem., 1883, 1569, J. Chem Soc., 46, 116; Dingl. pol. J., 248, 259; Wagner's Jsb., 28, 1;  
 \* Chemiker u Drugust 1883, 62. Rep anal Chem., 3, 124; Chem.-techn. Rep., 22, b, 236.  
 Precipitation as sulphide, ignition, solution of the residue in sulphurous and nitric acids, and titration with permanganate.
- 1884: 1. ANGER, C. Prüfung der Mangan titrirung mit Kaliumpermanganat in alkalischer Lösung.  
 Stahl. u. Eisen, 4, 156; Wagner's Jsb., 30, 397; Dingl. pol. J., 254, 139.  
 Titration with permanganate in the presence of sodium carbonate in excess.

- 1884: 2. ATKINSON, A. J. Volumetric Estimation of Manganese.  
Chem. News, **49**, 25; Jsb. Chem., **1884**, 1599.  
Determination in spiegeleisen by difference, after determination of the iron volumetrically. See Holdich, 1884: 8.
- 1884: 3. BLOXAM, C. L. Estimation of Manganese in Cast Iron and Spiegeleisen.  
Chem. News, **50**, 112; Jsb. Chem., **1884**, 1599; Chem. Centrbl., **1884**, 849; Ber., **17**, 508, Ref.; Chem. Ztg., **8**, 1436; J. Iron Steel Inst., **1884**, b, 584; J. Chem. Soc., **48**, 84; Wagner's Jsb., **31**, 18; J. Am. Chem. Soc., **6**, 242; Berg- u. hüttenm. Ztg., **43**, 520; Iron, **24**, 271; Chem. Ind., **7**, 362; Chem.-techn. Rep., **23**, b, 186; **24**, 249.  
Separation from iron by double acetate precipitation with the addition of phosphates, and final precipitation of manganese as phosphate.
- 1884: 4. CLASSEN, A. Entgegnung. (Wieland, 1884: 17.)  
Ber., **17**, 2351; Jsb. Chem., **1884**, 1540; Ztschr. anal. Chem., **24**, 247.  
Electrolytic determination. See also 1885: 4.
- 1884: 5. CLASSEN, A. Quantitative Analyse durch Elektrolyse.  
Ber., **17**, 2472 and 2484; Jsb. Chem., **1884**, 1543; Ztschr. anal. Chem., **24**, 255.  
Separation from copper and chromium by electrolysis.
- 1884: 6. GMELIN, O. Chemische Notizen für der Giesserei-Techniker.  
Oester. Ztschr. Berg- u. Hüttenw., **1884**, No. 49; Berg- u. hüttenm. Ztg., **44**, 23, Ref.  
A modification of the Volhard method of determination.
- 1884: 7. HANOWSKY. Ueber eine neue Anwendung des Wasserstoffsuperoxyds in der chemischen Analyse. (*Title from Chem. Ztg.*)  
\* Ber. oester. Ges. z. Förd. Chem. Ind., **1884**, 8; Jsb. Chem., **1884**, 1562; Rep. anal. Chem., **1884**, 220; Chem. Ztg., **8**, 789.  
Precipitation by hydrogen peroxide and ignition to manganomanganic oxide.
- 1884: 8. HOLDICH. Volumetric Estimation of Manganese.  
Chem. News, **49**, 9 and 57; Jsb. Chem., **1884**, 1598.  
Determination in spiegeleisen by difference, after volumetric determination of the iron.
- 1884: 9. HOLTHOF, C. Ueber Fällung des Mangans mit Brom.  
Ztschr. anal. Chem., **23**, 491; Jsb. Chem., **1884**, 1598; Chem. Centrbl., **1885**, 67; Ber., **18**, 34, Ref.; Wagner's Jsb., **30**, 397; Berg- u. hüttenm. Ztg., **44**, 55; J. Soc. Chem. Ind., **4**, 367.  
Precipitation by bromine in ammoniacal solution. Comments on Beilstein and Jawein chlorate method. See 1879: 1.

- 1884: 10. ILES, M. W. Manganese in Slags Formed by Argentiferous Lead Smelting.  
 School Mines Quart., 1884, 223; Chem. News, 50, 194; Berg- u huttenm Ztg., 44, 16.  
 Comments on Haswell's method of determination. See 1880: 5.
- 1884: 11. LEDEBUR, A. Ueber Manganbestimmung im Eisenbetriebe.  
 Chem. Ztg., 8, 910, 927, and 963; Iron, 24, 558; Jsb. Chem., 1884, 1597; J. Chem. Soc. (Lond.), 44, 242; J. Iron Steel Inst., 1884, a, 269; Berg- u huttenm Ztg., 43, 452; J. Soc. Chem. Ind., 3, 522.  
 Comments on the Pattinson (1879: 9), Hampe (1883: 4), and Volhard (1879: 14) methods.
- 1884: 12. MACKINTOSH, J. B. The Influence of Organic Matter and Iron on the Volumetric Determination of Manganese  
 Trans Am Inst Min Eng., 13, 39; Iron, 24, 224; Jsb. Chem., 1884, 1599; Chem. News 50, 75; J. Chem. Soc. (Lond.), 48, 85; Ber., 18, 126; Chem. Ztg., 8, 1144; Berg- u huttenm. Ztg., 43, 302; Bull. soc. chim. (2), 41, 354; Eng. Min. J., 37, 440.  
 Influence of organic matter on the Williams method of determination (1881: 18).
- 1884: 13. MACKINTOSH, J. B. Manganese Methods.  
 School Mines Quart., 6, 35.  
 Companson of methods.
- 1884: 14. MAUMENÉ, E. J. Sur l'existence du manganese dans les animaux et les plantes et sur son rôle dans la vie animale.  
 Bull. soc. chim. (2), 41, 451; (2), 42, 305; C. R., 98, 1416; Jsb. Chem., 1884, 1436.  
 Detection in plants, wines, and cereals by oxidation to permanganic acids. Various procedures briefly mentioned.
- 1884: 15. MEINEKE, C. Bestimmung des Mangans durch Permanganat. (*Title from Rep. anal. Chem.*)  
 \* Chem. Verst. Mitt., 1884, 63; Rep. anal. Chem., 5, 1; Jsb. Chem. 1884, 1596; Chem. Ztg., 9, 432; Ztschr. anal. Chem., 24, 423; Chem. Ind., 8, 86; Ber., 18, 125, Ref.; J. Am. Chem. Soc., 7, 91; Dingl. pol. J., 257, 202.  
 Comments on Guyard (1863: 2), Volhard (1879: 14), Morawski and Stingl (1878: 4), and Ledebur (1884: 11) methods of determination.
- 1884: 16. STONE, G. C. The Determination of Manganese in Spiegel.  
 Trans Am Inst Min Eng., 12, 295 and 514; School Mines Quart., 6, 24; J. Iron Steel Inst., 1884, a, 335; Eng. Min. J., 36, 228, 37, 138; Berg- u huttenm Ztg., 42, 442.  
 Shows variation in results obtained by different chemists when working upon the same sample.

- 1884: 17. WIELAND, J. Ueber elektrolytische Bestimmungen.  
Ber., 17, 1611 and 2931; Jsb. Chem., 1884, 1542; Chem. News, 50, 211.  
Electrolytic determination. See Classen, 1884: 4.
- 1884: 18. WOLFF, N. Eine maassanalytische Bestimmung des Mangans.  
Stahl u. Eisen, 4, 702; J. Iron Steel Inst., 1885, a, 301; Wagner's Jsb., 31, 12; Berg- u. hüttenm. Ztg., 44, 20; Dingl. pol. J., 257, 199; Chem.-techn. Rep., 23, b, 186.  
Separation from iron by means of zinc oxide, and titration with permanganate in the presence of the iron precipitate.
- 1885: 1. BLOXAM, C. L. On the Detection of Iron, Aluminium, Chromium, Manganese, Cobalt, Nickel, Calcium, and Magnesiums (as Phosphates) in the Precipitate Produced by Ammonia.  
Chem. News, 52, 109; Chem. Centrbl., 1885, 942; J. Chem. Soc., 48, 1264; Chem. Ind., 8, 324.  
Detection by means of phosphates.
- 1885: 2. CHARPENTIER, P. Sur une nouvelle méthode d'analyse volumétrique, applicable aux essais des bioxydes de manganèse.  
C. R., 101, 316; Chem. Centrbl., 1885, 715; Jsb. Chem., 1885, 1937; Chem. News, 52, 87; J. Iron Steel Inst., 1886, a, 401; Ztschr. anal. Chem., 28, 733; J. Chem. Soc. (Lond.), 48, 1162; Wagner's Jsb., 32, 345; Rep. anal. Chem., 5, 352; Dingl. pol. J., 259, 103; Chem.-techn. Rep., 24, b, 248; 25, a, 207; Chem. Ind., 9, 59.  
Determination of peroxide by passage of chlorine evolved on solution in hydrochloric acid into ferrous sulphate solution, and titration for ferric iron with potassium hydroxide in presence of potassium sulphocyanide.
- 1885: 3. CHEEVER, B. W. Estimation of Manganese, Carbon, and Phosphorus in Iron and Steel.  
Trans. Am. Inst. Min. Eng., 14, 372; J. Iron Steel Inst., 1885, 736.  
Comments on the Williams method. (1881: 18)
- 1885: 4. CLASSEN, A. Bemerkungen zu der Antwort des Herrn Wieland.  
Ber., 18, 168.  
Determination by electrolysis. See 1884: 4 and 1884: 17.
- 1885: 5. CLASSEN, A. Quantitative Analyse durch Elektrolyse.  
Ber., 18, 1793; Jsb. Chem., 1885, 1883; Bull. soc. chim. (2), 45, 893; Dingl. pol. J., 259, 93; Ztschr. anal. Chem., 25, 110.  
Electrolytic separation from iron.
- 1885: 6. DEANE, L. M. Ferricyanide of Manganese.  
Chem. News, 51, 164 and 248; Jsb. Chem., 1885, 1937.  
Solubility of manganese ferricyanide. Note on an error in Fresenius' Qualitative Analysis. See 1885: 8.

- 1885 7. DIEHL, W. Zur Bestimmung des Mangans  
 Chem Ind., 8, 306, Chem Centrbl., 1885, 713; Jsb Chem 1885, 1934; J Chem Soc (Lond.), 50, 101, Wagner's Jsb., 31, 89, Rep anal Chem., 5, 300, Dingl pol J., 258, 95, Chem Ztg., 8, 1502, Chem-techn. Rep., 24, b, 248.  
 Precipitation by bromine and ammonia, solution in hydrochloric acid and estimation of the iron by the amount of iodine liberated from potassium iodide.
- 1885 8. DRAPER, C. N. Solubility of Manganese Ferricyanide in Hydrochloric Acid.  
 Chem News, 51, 226; Jsb Chem., 1885, 1937.  
 See 1885 6.
- 1885 9. HAMPE, W. Ein einfaches Verfahren zur Trennung des Zinks von allen Metallen seiner Gruppe.  
 Chem. Ztg., 9, 543; Chem Centrbl., 1885, 603; Jsb Chem., 1885, 1938; Ztschr anal Chem., 24, 588.  
 Separation from zinc by precipitation with hydrogen sulphide in presence of formates.
- 1885 10. HAMPE, W. Die maassanalytische Bestimmung des Mangans in Legirungen Mineralien u. s. w. mittelst Kaliumchlorats.  
 Chem Ztg., 9, 1083 and 1515; Berg u. hüttenm Ztg., 44, 328, Monat scientif., 27, 1046; Chem Centrbl., 1885, 714; Jsb Chem., 1885, 1936; Ber., 18, 580, Ref., J Iron Steel Inst., 1885, b, 652, Wagner's Jsb., 31, 311; Rep anal Chem., 5, 299, Techn chem Jahrb., 8, 17 and 53, J Soc Chem Ind., 4, 690, Analyst., 10, 101.  
 Precipitation with potassium chlorate, solution of the precipitate, addition of ferrous sulphate, and titration with permanganate.  
 See 1883 4.
- 1885 11. V. JUPTNER, H. Eine neue Manganbestimmungsmethode auf gewichtsanalytischem Wege  
 Chem Ztg., 9, 692; Jsb Chem., 1885, 1935, Ztschr anal Chem., 25, 217; J. Iron Steel Inst., 1885, a, 247; Wagner's Jsb., 31, 14, J Soc Chem Ind., 4, 510, Dingl pol J., 257, 201, Analyst., 10, 140, Chem techn. Rep., 24, 249.  
 Precipitation as manganous sulphide, after removal of the iron with barium carbonate, solution of the precipitate in acetic acid, evaporation and ignition to mangano-manganese oxide.
- 1885 12. KALMANN, W., and SMOLKA, A. Ueber eine neue Methode zur Bestimmung des Mangans in Spiegeleisen, Ferromangan und den wichtigsten Erzen.  
 Wien. Acad. Ber. (2 Abt.) 91, 40, Monatsh., 6, 65; Chem Centrbl., 1885, 235, Jsb Chem., 1885, 1936, Ztschr anal Chem., 24, 590.



- 1886: 4. BEIN, S. Ueber die quantitative Abscheidung und Bestimmung des Zinks.

Rep. anal. Chem., **1886**, 275; Jsb. Chem., **1886**, 1939.

Separation from iron by the succinate method, and from zinc by treating the ignited oxides with acetic acid.

- 1886: 5. BLUM, L. Ueber die directe Trennung des Mangans von Eisen.

Ztschr. anal. Chem., **25**, 519; Chem. Centrbl., **1887**, 97; Jsb. Chem., **1886**, 1934; Chem. News, **55**, 236; Chem. Ztg., **11**, 251; Ber., **19**, 850, Ref.; J. Chem. Soc. (Lond.), **52**, 183; Chem. Ind., **9**, 383; Wagner's Jsb., **32**, 344; Rep. anal. Chem., **6**, 662; Analyst, **11**, 234; J. Am. Chem. Soc., **9**, 10; Dingl. pol. J., **262**, 335.

Separation from iron by precipitation as ferrocyanide from ammoniacal tartrate solution.

- 1886: 6. CARNOT, A. Séparation successive du cuivre, du cadmium, du zinc et du nickel ou du cobalt (fer et manganèse).

Bull. soc. chim. (2), **46**, 812; C. R., **102**, 621 and 678; Eng. Min. J., **41**, 340; Jsb. Chem., **1886**, 1948; Chem. News, **53**, 196; Ztschr. anal. Chem. (1889), **28**, 344; Chem. Ztg., **11**, 4, Ref.; Ber., **19**, 364, Ref.; J. Chem. Soc. (Lond.), **50**, 650; J. Iron Steel Inst., **1887**, a, 470.

Separation from nickel and iron by means of hydrogen sulphide in acetic acid solution.

- 1886: 7. CHRISTENSEN, O. T. Beiträge zur Chemie des Mangans und des Fluors.

J. prakt. Chem., **34**, 41; **35**, 161; Chem. News, **54**, 96; **55**, 153.

Detection by the formation of permanganic acid on the electrolysis of the manganese salt in hydrofluoric acid solution.

- 1886: 8. CHEEVER, B. W. Colorimetric Estimation of Manganese in Steel.

Trans. Am. Inst. Min. Eng., **15**, 102; J. Iron Steel Inst., **1885**, b, 736; J. Anal. Chem., **1**, 88.

Criticisms of the method of determination by means of lead peroxide and nitric acid.

- 1886: 9. CLASSEN, A. See 1884: 4.

- 1886: 10. CLASSEN, A. See 1884: 5.

- 1886: 11. CLASSEN, A., and LUDWIG, R. Quantitative Analyse durch Elektrolyse.

Ber., **19**, 323; Jsb. Chem., **1886**, 1894.

Separation from mercury by electrolysis.

- 1886 12. DEANE, L. M. On the Separation of Silica in the Estimation of Manganese in Pig Iron, and On the Estimation of Phosphorus in Pig Iron and Steel  
Chem News 54, 174. Jsb Chem. 1886, 1932. Ber. 19, 851, Ref.; J Chem Soc (Lond), 52, 183; Chem-techn Centr Anz., 1887, 187. Chem-techn Rep. 26, a, 205  
Separation from iron by the basic acetate method, and final separation from silica after igniting and weighing the manganese oxide.
- 1886 13. HUNT, A. E. The Estimation of Manganese in Iron and Steel by the Color Method.  
Trans Am Inst Min Eng. 15, 104. J Iron Steel Inst. 1886, b, 1020. J Anal Chem, 1, 89.  
Oxidation with lead peroxide in the presence of nitric acid
- 1886 14. LANGBEIN, E. Zur Nickelanalyse  
Rep anal Chem, 1886, 423; Jsb. Chem. 1886, 1937. Dingl pol. J., 261, 495  
Separation from nickel by electrolysis.
- 1886 14a. LOSEKANN, G., and MEYER, T. Eine neue Methode der Zinkbestimmung.  
Chem Ztg. 10, 729  
Separation from zinc by means of phosphate unpracticable
- 1886 15. MEINEKE, C. Eine Methode schneller Bestimmung des Mangans in Eisensorten mittels Permanganat  
Rep anal Chem 6, 252. Jsb Chem. 1886, 1933. Ber. 19, 464. Ref. Chem Ind. 9, 193. Stahl u Eisen 6, 444. Wagner's Jsb. 32, 5; Berg- u. hüttenm. Ztg., 46, 43; J. Soc. Chem. Ind., 5, 508; Techn-chem Jahrb. 9, 18. Chem-techn Rep. 25, a, 205  
Use of permanganate method (Meineke) with antimonious chloride. See 1883 10
- 1886 16. MÜLLER, C. G. Ueber eine schnelle und scharfe Methode zur gewichtsanalytischen Bestimmung des Mangans im Spiegeleisen und Ferromangan.  
Stahl u Eisen 6, 98. Wagner's Jsb. 32, 5. Berg- u. hüttenm. Ztg. 45, 149. Techn-chem Jahrb. 8, 17. J Iron Steel Inst. 1886, 392  
Separation from iron by the basic acetate method, precipitation by bromine, and subsequently as manganous carbonate, or, separation by the acetate method and re-precipitation with hydrogen peroxide and determination as mangano-manganic oxide.
- 1886 17. MÜLLER, C. G. Ueber die neue Meinekesche Manganbestimmung.  
Stahl u Eisen 6, 590. Chem Ztg. 11, 216. Rep., Wagner's Jsb. 32, 5; Rep. anal. Chem., 6, 595; Berg- u. hüttenm. Ztg., 45, 452; J Iron Steel Inst. 1886, 1022. Chem-techn Rep. 25, a, 206  
Comments on the Meineke method (1883 10)

## 56 BIBLIOGRAPHY OF ANALYTICAL CHEMISTRY OF MANGANESE

- 1886: 18. MOORE, T. Quantitative Chemical Analysis by Electrolysis.  
Chem. News, 53, 209; Jsb. Chem., 1886, 1895; J. Chem. Soc. (Lond.), 50, 921; Eng. Min. J., 41, 371.  
Electrolytic deposition and estimation as oxide.
- 1886: 19. MOORE, T. On the Estimation of Nickel in Mattes, Ores, Slags, etc.  
Chem. News, 54, 300; Jsb. Chem., 1886, 1938; Ztschr. anal. Chem., 26, 732.  
Separation from nickel by electrolysis.
- 1886: 20. PATTINSON, J. The Volumetric Test for Manganese.  
J. Soc. Chem. Ind., 5, 422; Monit. scientif., 28, 1048; Jsb. Chem., 1886, 1934.  
Reply to the criticisms of Atkinson. See 1886: 1.
- 1886: 21. PERILLOU. Dosage rapide du carbon, du phosphore, etc.  
Bull. soc. ind. mineral. (2), 13, 108; Berg- u. hüttenm. Ztg., 45, 6, and 32; Jsb. Chem., 1886, 1933; Ber., 1886, 181, Ref.; Wagner's Jsb., 32, 11.  
Volumetric method; oxidation by lead peroxide, and titration with ferrous sulphate in nitric acid solution.
- 1886: 22. REINHARDT, C. Gewichtsanalytische Manganbestimmung.  
Chem. Ztg., 10, 323, 357, and 372; Berg- u. hüttenm. Ztg., 45, 163; J. Soc. Chem. Ind., 5, 391.  
Separation from iron by the basic acetate method, and precipitation by (1) a current of bromine-ammonia, or (2) bromine in hydrochloric acid, and a current of gaseous ammonia.
- 1886: 23. REINHARDT, C. Ueber Mangantitrationsmethoden nach N. Wolff, E. Belani, Hampe und Meineke.  
Stahl. u. Eisen, 6, 150; Wagner's Jsb., 32, 9; Berg- u. hüttenm. Ztg., 45, 192; J. Iron Steel Inst., 1886, 393.  
See 1884: 18; 1883: 4; 1883: 10; 1887: 17.
- 1886: 24. SCHÖFFEL, R., and DONATH, E. Ueber die volumetrische Bestimmung des Mangans.  
Monatsh. Chem., 7, 639; Wein. Acad. Ber. (2 Abth.), 94, 844; Stahl u. Eisen, 7, 30; Dingl. pol. J., 264, 34; Berg- u. hüttenm. Ztg., 1887, 60; Oester. Ztschr. Berg- u. Hüttenw., 35, 70; Chem. Centrbl., 1887, 152 and 285; Jsb. Chem., 1887, 2429; J. Chem. Soc. (Lond.), 52, 399; Ztg. angew. Chem., 1887, a, 159; Chem. Ztg., 11, 111, Rep.; Ber., 20, 115, Ref.; Bull. soc. chim. (2), 49, 48; Chem. Ind., 10, 230 and 279; Wagner's Jsb., 33, 273; J. Iron Steel Inst., 1887, a, 468; Techn.-chem. Jahrb., 9, 18 and 98; Chem.-techn. Rep., 26, a, 296.  
Volumetric method; addition of an excess of permanganate and titration with arsenious acid.

- 1886: 25. SETTERWALL, A. Om bestämmande i jern och stål m. m. af dels mangan formedelst titrering  
 Jern-Kont. Ann., 1886, 427. \*Z. O. S. Berg u. H. V., 25, 410;  
 Techn.-chem. Jahrb., 9, 19.  
 Determination by oxidation with lead peroxide in nitric acid solution, and titration with arsenious oxide.
- 1886: 26. SPRENGER. Verfahren zur Analyse von Eisen und Stahl.  
 Berg- u. hüttenm. Ztg., 45, 462.  
 Separation from iron by the basic acetate method, from nickel and cobalt by hydrogen sulphide, and precipitation by bromine.
- 1886: 27. WOLFF, N. Ueber Manganbestimmungen.  
 Stahl u. Eisen, 6, 105; Wagner's Jsb., 32, 11.  
 Precipitation by bromine. Also volumetric determination by titration in presence of the precipitated iron. See 1883: 22 and 1884: 18.
- 1886: 28. ZIMMERMANN, R. Zur N. Wolff'schen Mangantitrirung.  
 Stahl u. Eisen, 6, 362; Wagner's Jsb., 32, 11.  
 See 1884: 18 and 1886: 27.
- 1887: 1. BABBITT, H. C. Manganese in Iron and Steel  
 Am. Chem. J., 9, 58; Chem. Centrbl., 1887, 1185; Jsb. Chem., 1887, 2515; J. Iron Steel Inst., 1887, b, 369; J. Chem. Soc. (Lond.), 52, 619; Wagner's Jsb., 34, 200.  
 Oxidation to permanganic acid by means of red lead, and titration with standard reducing agents.
- 1887: 2. BAYLEY, T. On the Separation of Zinc from Nickel and Manganese, and the Estimation of Nickel  
 J. Soc. Chem. Ind., 6, 499; Chem. Centrbl., 1887, 1183; Chem. Ztg., 11, 203, Rep.; Ber., 21, 39, Ref.; J. Chem. Soc. (Lond.), 54, 388.  
 Separation from zinc. Precipitation with sodium hydrogen phosphate and ammonia, addition of just enough hydrochloric acid to effect re-solution and precipitation of the zinc with hydrogen sulphide.
- 1887: 3. BLAIR, A. A. The Methods Employed in the Analysis of Iron Ores.  
 Chem. News, 56, 107. Jsb. Chem., 1887, 2428.  
 Determination as phosphate.

- 1887: 4. BRAND, A. Ueber eine Abänderung der titrimetrischen Manganbestimmung durch Kaliumpermanganat.  
 Stahl u. Eisen, **9**, 399; Chem. Centrbl., **1887**, 876; Jsb. Chem., **1887**, 2429; Wagner's Jsb., **33**, 271; J. Iron Steel Inst., **1887**, b, 368; Berg- u. hüttenm. Ztg., **47**, 20; Techn.-chem. Jahrb., **10**, 16.  
 Volumetric determination by means of permanganate. Oxidation of the iron and destruction of organic matter with barium peroxide.
- 1887: 5. CHEEVER, B. W. Conversion of Manganese to Permanganic Acid.  
 J. Anal. Chem., **1**, 176.  
 A study of the action of lead peroxide in nitric acid solution.
- 1887: 6. CARNOT, A. Sur diverses réactions des vanadates et leur emploi dans l'analyse chimique.  
 C. R., **104**, 1803; Chem. News, **56**, 16.  
 Precipitation as vanadate in ammoniacal solution.
- 1887: 7. DONATH, E., and ZELLER, R. Einige Anwendungen des Wasserstoffsuperoxydes.  
 Rep. anal. Chem., **7**, 36; Jsb. Chem., **1887**, 2428; Ber., **20**, 118, Ref.; J. Anal. Chem., **1**, 321.  
 Separation from zinc, nickel, and cobalt by means of hydrogen peroxide.
- 1887: 8. HAUSHOFER. (Title unknown.)  
 \* Jahrb. f. Min., **1**, 13; J. Chem. Soc. (Lond.), **52**, 300.  
 Detection by a microscopic study of the crystals formed on cooling a hot, concentrated sulphuric acid solution of the substance.
- 1887: 9. JOLLES, A. Ueber Kaliumpermanganat und seiner Bedeutung in der analytischen Chemie.  
 Schlesische Ges. vaterl. Cultur. Breslau, **65**, 150; Rep. anal. Chem., **7**, 491; Ztschr. anal. Chem., **28**, 238; Wagner's Jsb., **33**, 272; J. Chem. Soc., (Lond.) (1889), **56**, 798; Chem. Ztg., **11**, 819.  
 A study of the Volhard Method. (1879: 14).
- 1887: 10. KLOBB, T. Permanganates ammonio-cobaltiques.  
 Ann. chim. phys. (6), **12**, 26.  
 Separation from cobalt by precipitation as sulphide after the formation of cobaltic cyanide by the addition of a solution of hydrocyanic acid.
- 1887: 11. V. KNORRE, G. Ueber eine neue Methode zur Trennung von Eisen und Mangan.  
 Stahl u. Eisen, **7**, 178; Chem. Ind., **1887**, 141; Dingl. pol. J., **265**, 420; Techn.-chem. Jahrb., **9**, 18; **10**, 15.  
 Use of nitroso- $\beta$ -naphthol to separate manganese from iron or copper.

- 1887 12 v KNORRE, G. Ueber die Verwendbarkeit des Nitroso- $\beta$ -naphthols in der quantitativen Analyse.

Ber. 20, 283. Ztschr. anal. Chem., 28, 235. Chem. News, 59, 232.  
J. Iron Steel Inst. 1887, a, 470.  
Separation from iron and copper.

- 1887 13 LAX, E. Beiträge zur Maassanalyse des Mangans. (Title from Berg- u. hüttenm. Ztg.)

\* Inaugur. Dissert., Berlin, Berg- u. hüttenm. Ztg., 46, 243. Chem. Centrbl., 1887, 970. Chem. Ztg., 11, 514. Oester. Ztschr. Berg- u. Hüttenw., 35, 427. Ber., 20, 740. Ref., Techn.-chem. Jahrb., 10, 88.

General discussion of the Schöffel and Donath, Kessler, Hampe, Meineke and Pattinson methods. See 1883 17, 1872 5, 1883 4, 1883 10 and 1879 9.

- 1887 14. MEINEKE, C. Bestimmung des Mangans durch Fällung mittels Quecksilberoxyd und Brom.

Rep. anal. Chem., 7, 54 and 67. Analyst., 12, 48 and 72. Chem. Centrbl., 1887, 554. Jsb. Chem., 1887, 2429. J. Iron Steel Inst., 1887, a, 469. Ztschr. angew. Chem., 1887, 14. Chem. Ztg., 11, 51. Rep., Ber., 20, 151. Ref., J. Chem. Soc. (Lond.), 52, 1139. Stahl u. Eisen, 7, 287. Wagner's Jst., 33, 273. Berg- u. hüttenm. Ztg., 46, 187. Techn.-chem. Jahrb., 9, 19 and 97.

Volumetric determination. Precipitation with mercuric oxide and bromine water, solution of the precipitated peroxide in an excess of oxalic acid and titration for this excess with permanganate.

- 1887 15. MEINEKE, C. Zur Maassanalyse des Mangans.

Chem. Ztg., 11, 137. Chem. Centrbl., 1887, 230. J. Chem. Soc. (Lond.), 52, 531. Berg- u. hüttenm. Ztg., 46, 135. J. Soc. Chem. Ind., 6, 456. Techn.-chem. Jahrb., 10, 16.

On the cause of the incomplete precipitation obtained by the chlorate method. See also 1885 10 and 1885 15.

- 1887 16 MORGAN, J. J. Rapid Methods for the Determination of Silicon, Sulphur, and Manganese in Iron and Steel.

\* Ind. Rev.; Chem. News, 56, 82; Chem. Centrbl., 1887, 1268; Jsb. Chem., 1887, 2427. Ztschr. chem. Ind., 1887, b, 246. Chem. Ztg., 11, 219. Rep.; J. Chem. Soc. (Lond.), 52, 1140; Wagner's Jsb., 33, 271. J. Anal. Chem., 1, 418. Iron, 30, 312. Techn.-chem. Jahrb., 10, 16.

Colorimetric method by oxidation with lead peroxide in nitric acid solution. See also Peters 1876 5.

- 1887: 17. REINHARDT, C. Eine weitere Verbesserung der Belanischen Mangantitration.

Stahl u. Eisen, 7, 709; Wagner's Jsb., 33, 586; J. Iron Steel Inst., 1887, b, 367; Techn.-chem. Jahrb., 10, 16; Berg- u. hüttenm. Ztg., 46, 451; Chem.-techn. Rep., 26, b, 317.

Separation from iron by zinc oxide, precipitation by bromine in the presence of zinc oxide, solution in ferrous sulphate, and titration with potassium permanganate.

- 1887: 18. See 1888: 21.

- 1887: 19. L'ASSEMBLÉE REP. FAB. RAILS, ETC. Contributions à l'analyse chimique de fer, de l'aciers et de la fonte.

\* Technik (Moscow); Monit. scientif. (4), 1, 241; Jsb. Chem., 1887, 2427.

Determination by the Deshayes method. See 1878: 2.

- 1888: 1. CAMPBELL, A. C. Separation of Ferric Iron from Cobalt, Nickel, and Manganese.

J. Anal. Chem., 2, 291; Ztschr. anal. Chem., 30, 616; Chem. Ztg., 12, 250, Rep.; J. Chem. Soc. (Lond.), (1892) 62, 103.

Separation from iron by precipitation with lead carbonate.

- 1888: 2. CARNOT, A. Sur l'emploi de l'eau oxygénée pour le dosage des métaux de la famille du fer.

C. R., 107, 997 and 1150; Bull. soc. chim. (3), 1, 279; Chem. News, 59, 15; Jsb. Chem., 1888, 2552; 1889, 2395; Chem. Centrbl., 1889, 143; Chem. Ztg., 13, 7 and 16, Rep.; Eng. Min. J., 47, 141; J. Soc. Chem. Ind., 8, 216; Ztschr. anal. Chem., 29, 336; Ztschr. angew. Chem., 1888, 71; Ber., 22, 111, Ref.; J. Chem. Soc. (Lond.), 56, 443; J. Iron Steel Inst., 1889, a, 394.

Precipitation by means of hydrogen peroxide, solution in oxalic acid, and titration with potassium permanganate.

- 1888: 3. FRIEDMANN, A. Zur Bestimmung des Mangans in Eisen.

Stahl u. Eisen, 8, 315; Jsb. Chem., 1888, 2553; Ztschr. angew. Chem., 1888, 415; Wagner's Jsb., 34, 196; Techn.-chem. Jahrb., 11, 19; J. Iron and Steel Inst., 1888, b, 328.

Decomposition by means of chlorine and final precipitation and determination as sulphide (Rose method, 1860: 5).

- 1888: 4. GHILIAN, A. Description et controle de la méthode volumétrique de dosage de manganèse.

Rev. univ. des mines (3), 1888, 270; Berg- u. hüttenm. Ztg., 1888, 454; Chem. News, 59, 121; Jsb. Chem., 1889, 2399; Wagner's Jsb., 34, 200.

Separation from iron by means of ammonium carbonate, ammonium succinate, or sodium acetate, and titration with permanganate in the presence of an excess of zinc oxide.



- 1888: 5. DE LA HARPE, C., and RÉVERDIN, F. Petites notices analytiques.  
 Bull. soc. chim. (3), 1, 164; Chem. Centrbl., 1889, a, 391; Ber., 22, 355. Ref.; Wagner's Jsb., 35, 570; J. Anal. Chem., 3, 321; J. Soc. Chem. Ind., 8, 307.  
 Apparatus for the determination of peroxide by the Bunsen method. (1853: 1.)
- 1888: 6. ILES, M. W. Lead Slags.  
 Chem. News, 57, 18; Ztschr. angew. Chem., 1888, 197.  
 Determination in lead slags by the Volhard method (1879: 14.)
- 1888: 7. JULIAN, F. A Method for the Determination of Manganese in Steel.  
 J. Anal. Chem., 2, 249; Trans. Am. Inst. Min. Eng., 16, 355; Chem. Centrbl., 1888, 1400; Ztschr. anal. Chem., 32, 370; Ztschr. angew. Chem., 1888, 521; Chem. News, 58, 209; Chem. Ztg., 12, 251.  
 Rep.; Wagner's Jsb., 34, 193; Rev. univ. des mines, 42, 301; Eng. Min. J., 46, 413; J. Iron and Steel Inst., 1888, a, 376; 1889, a, 394; Berg- u. hüttenm. Ztg., 47, 348; Oester. Ztschr. Berg- u. Hüttenw., 37, 156; Techn.-chem. Jahrb., 11, 79.  
 Precipitation with chlorate, solution without filtration with the aid of ferrous sulphate or oxalic acid, and titration with permanganate
- 1888: 8. KLEIN, J. Ueber einige neue Reactionen.  
 Chem. Ztg., 12, 1321; Berg- u. hüttenm. Ztg., 47, 425; Arch. Pharm., 227, 77.  
 Test for manganese by means of hydrogen peroxide in alkaline solution.
- 1888: 9. DE KONINCK, L. L., and LECRENIER, A. Bestimmung des veringbaren Sauerstoffs in den Hyperoxyden mittels gasförmigen Salzsäure  
 Ztschr. angew. Chem., 1888, 353; Wagner's Jsb., 34, 515; Eng. Min. J., 47, 460; Berg- u. hüttenm. Ztg., 1888, 295; Chem.-techn. Rep., 27, a, 235.  
 Volumetric determination of peroxide depending on the evolution of chlorine gas; reaction of the latter with ferrous sulphate, and of the product with potassium iodide in excess
- 1888: 10. MEINKE, C. Studien über die Analyse von Rohstoffen und Production der Eisenindustrie.  
 Ztschr. angew. Chem., 1888, 3, 219 and 252; Chem. Centrbl., 1888, 422 and 865; Jsb. Chem., 1888, 2550; Ztschr. anal. Chem., 36, 700; Chem. Ztg., 12, 20; Ber., 21, 311; Ref.; Wagner's Jsb., 34, 198; Berg- u. hüttenm. Ztg., 47, 81; J. Chem. Soc. (Lond.), 54, 1132; 56, 309; J. Iron Steel Inst., 1888, b, 326.  
 Criticism of the various methods of separation from iron. Precipitation as sulphide, as carbonate, and as phosphate; separation from iron by means of nitroso- $\beta$ -naphthol, barium carbonate, mercuric and zinc oxides, and by the acetate and sulphate methods

- 1888: 11. MOORE, T. Methods for the Separation of Iron, Nickel, Cobalt, Manganese, Zinc, and Aluminium.

Chem. News, **57**, 125; Chem. Centrbl., **1888**, 644; Jsb. Chem., **1888**, 2553; J. Chem. Soc. (Lond.), **54**, 631; Ber., **21**, 544, Ref.; J. Anal. Chem., **2**, 309.

Separation from iron, nickel, and cobalt, by solution of the mixed carbonate precipitate with potassium cyanide, and precipitation of the manganese from this solution as sulphide, or as hydrated peroxide by means of hydrogen peroxide.

- 1888: 12. OETTEL, F. Ueber die Analyse des Neusilbers.

Ztschr. anal. Chem., **27**, 16; Jsb. Chem., **1888**, 2554.

Separation from iron and cobalt by electrolysis; precipitation by bromine, and determination as mangano-manganic oxide.

- 1888: 13. REINHARDT, C. Zur Bestimmung des Mangans in siliciumreichen aber manganarmen Roheisensorten.

Ztschr. angew. Chem., **1888**, 108; Chem. Centrbl., **1888**, 500; Jsb. Chem., **1888**, 2553; Ztschr. anal. Chem., **32**, 368; Chem. News, **58**, 171; Chem. Ztg., **12**, 66, Rep.; Chem. Ind., **11**, 186; J. Iron Steel Inst., **1888**, a, 377; b, 330; J. Chem. Soc. (Lond.), **54**, 1132; Wagner's Jsb., **34**, 197; Berg- u. hüttenm. Ztg., **47**, 221; J. Soc. Chem. Ind., **7**, 234; Analyst, **13**, 74.

Precipitation by bromine water in presence of sodium acetate and zinc oxide, re-solution in an excess of an oxalate solution, and titration for this excess with permanganate. Comments on chlorate method.

- 1888: 14. v. REIS, M. A. Vorschläge zur Einführung von einheitlichen analytischen Methoden für Eisenhüttenlaboratorien.

Stahl. u. Eisen, **8**, 97; Techn.-chem. Jahrb., **10**, 16.

Separation from iron by the acetate method, and determination by precipitation by bromine and ignition to mangano-manganic oxide.

- 1888: 15. SCHNEIDER, L. Eine neue Bestimmungsmethode des Mangans.

Wien. Akad. Ber. (2 b), **97**, 256; Monatsh. Chem., **9**, 242; Dingl. pol. J., **269**, 224; Chem. Ind., **11**, 444; J. Soc. Chem. Ind., **7**, 525 and 603; Chem. Centrbl., **1888**, 940; Jsb. Chem., **1888**, 2552; J. Chem. Soc. (Lond.), **54**, 873; Ztschr. angew. Chem. **1888**, 417; Chem. Ztg., **12**, 129, Rep.; Ber., **21**, 451, Ref.; Wagner's Jsb., **34**, 193; Berg- u. hüttenm. Ztg., **47**, 269; Arch. Pharm., **226**, 658; J. Anal. Chem., **2**, 322; Techn.-chem., Jahrb. **11**, 19; Chem.-techn. Rep., **27**, a, 234.

Determination by oxidation with bismuth tetroxide and titration with hydrogen peroxide.

- 1888: 16. SCHÜRMANN. Ueber die Verwandtschaft der Schwermetalle zum Schwefel.

Ann. Chem. (Liebig), **249**, 329.

Filtration of sulphides aided by a concentrated solution of sodium acetate.

- 1888: 17. STEIN, G. Zur Manganbestimmung in Nahrungs- und Genussmitteln.

Chem. Ztg., **12**, 446; Chem. Centrbl., **1888**, 645; J. Chem. Soc. (Lond.), **56**, 188; Chem.-techn. Rep., **27**, a, 257.

Determination in the ashes of food-stuffs by treatment with sodium nitrate, sulphuric acid, and lead peroxide, and titration for the permanganate formed with a standard ferrous salt solution. See 1888: 20.

- 1888: 18. THORPE, T. E., and HAMBLY, F. J. Note on Chatard's Method for the Estimation of Small Quantities of Manganese.

J. Chem. Soc. (Lond.), **53**, 182; Jsb. Chem., **1888**, 2552; Ztschr. anal. Chem., **32**, 367; Chem. Ztg., **12**, 92, Rep.; Ber., **21**, 374, Ref.; J. Iron Steel Inst., **1888**, b, 329; J. Anal. Chem., **2**, 197; Techn.-chem. Jahrb., **10**, 16; Chem. News, **57**, 48.

Oxidation with lead peroxide, and titration with ammonium oxalate. See 1871: 2.

- 1888: 19. THORPE, T. E., and HAMBLY, F. J. On Manganese Trioxide.

J. Chem. Soc. (Lond.), **53**, 179; Chem. Ztg., **12**, 155.

Description of Chatard's volumetric method. See 1871: 2 and 1888: 18.

- 1888: 20. WEISSMANN, G. Kurze Methode der Manganbestimmung im Roheisen, Stahl, etc.

Chem. Ztg., **12**, 205; Chem. Centrbl., **1888**, 423; Ber., **1888**, 311, Ref.; Ztschr. anal. Chem., **32**, 366; Chem. Ind., **11**, 212; Wagner's Jsb., **34**, 198; J. Chem. Soc. (Lond.), **54**, 992; J. Iron and Steel Inst., **1888**, a, 377; **1893**, b, 531; Berg- u. hüttenm. Ztg., **47**, 113; J. Soc. Chem. Ind., **7**, 235; Dingl. pol. J., **267**, 528; Techn.-chem. Jahrb., **10**, 17; Chem.-techn. Rep., **27**, a, 234.

Modification of the Chatard method. Oxidation to permanganic acid by lead peroxide and titration with ferrous ammonium sulphate. See 1871: 2 and 1888: 17.

- 1888: 21. ——. Analytical Chemistry as Applied to the Manufacture of Iron and Steel.

Iron, **30**, 360 and 504; Stahl und Eisen, **8**, 607; Wagner's Jsb., **35**, 173.

Separation from iron by the acetate method, precipitation by bromine, and determination as mangano-manganic oxide, as manganous sulphate, or by difference after determination of the iron.

- 1889: 1. ALT, H. Zur Fällung von Mangan als Hyperoxyd.  
Chem. Ztg., 13, 1339; Chem. Centrbl. 1889, b, 859; Jsb. Chem., 1889, 2399; J. Chem. Soc. (Lond.), 58, 419; Stahl u. Eisen, 9, 961; Berg- u. hüttenm. Ztg. 48, 429; J. Anal. Chem., 3, 425; Techn.-chem. Jahrb., 12, 13.  
Adhesion of precipitate to glass said to be prevented by boiling the solution to expel air.
- 1889: 2. BLUM, L. Eine Fehlerquelle bei der Trennung geringer Manganmengen von viel Kalk durch Schwefelammonium.  
Ztschr. anal. Chem., 28, 454; Chem. Centrbl., 1889, b, 513; J. Chem. Soc. (Lond.), 56, 1087; Ber., 22, 706, Ref.; Chem. Ind., 13, 89; Stahl u. Eisen, 9, 960; School Mines Quart., 11, 69; J. Iron Steel Inst., 1890, a, 372; J. Soc. Chem. Ind., 8, 922; Analyst, 14, 192.  
Separation from calcium by means of ammonium sulphide.
- 1889: 3. BRAND, A. Ueber die Anwendung von pyrophosphorsauren Doppelsalzen zur Bestimmung und Trennung von Metallen durch Electrolyse.  
Ztschr. anal. Chem., 28, 586, 599, and 604; Chem. Centrbl., 1890, a, 140; Chem. Ind., 13, 90; J. Chem. Soc. (Lond.), 58, 294.  
Electrolytic determination, and separation from nickel, cobalt, copper, cadmium, zinc, mercury, and iron.
- 1889: 4. FINKENER. Zur Bestimmung des wirksamen Sauerstoffs.  
Mitthl. Vers. Berlin, 1889, 158; Jsb. Chem., 1890, 2444; Dingl. pol. J., 276, 479; Ztschr. angew. Chem., 1890, 271.  
Comments on Bunsen, ferrous sulphate, and oxalic acid (volumetric) methods, for the determination of peroxide.
- 1889: 5. FRIEDBURG, L. H. Notes on Quantitative Analysis.  
Chem. News, 62, 23; Jsb. Chem., 1890, 2379.  
Determination in silicates.
- 1889: 5a. GOOCH, F. A. and WHITFIELD, J. E. Analyses of Waters of the Yellowstone National Park.  
Bull. U. S. Geol. Surv., No. 47, 27.  
Determination in mineral waters.
- 1889: 6. KLEIN, J. Ueber die Empfindlichkeit des Mangannachweises mittels Wasserstoffsuperoxyd.  
Arch. Pharm. (3), 27, 77; Chem. Centrbl., 1889, a, 391; Jsb. Chem., 1889, 2398; Chem. Ztg., 13, 83, Rep.; Ber., 22, 171, Ref.; J. Chem. Soc., 56, 653; Berg- u. hüttenm. Ztg., 48, 164; Chem.-techn. Rep., 28, a, 240.  
Detection, in presence of cobalt, by means of hydrogen peroxide.

- 1889: 7. KOHN, C. J., and WOODGATE, J. The Application of Electrolysis to Quantitative Analysis  
J. Soc. Chem. Ind., 8, 256; Chem. Centrbl., 1889, b, 54; Jsb. Chem., 1889, 2304  
Electrolytic separation from iron
- 1889: 8. DE KONINCK, L. L. Zur Prüfung der Reagentien.  
Ztschr. angew. Chem., 1889, 4, Jsb. Chem., 1889, 2299, Rev. univers. des mines, 1889, 308; Berg- u. hüttenm. Ztg., 48, 183; Chem. News, 59, 230.  
Detection of manganese in lead peroxide by decomposition with hot, concentrated sulphuric acid, and the addition of more lead peroxide to form permanganic acid
- 1889: 9. MAYER, F. Zur qualitative Analyse des Schwefelammoniumniederschlags  
Ber., 22, 2627, Jsb. Chem., 1889, 2391  
Separation from iron and aluminum by the acetate method.
- 1889: 10. M'KELLAR, W. G. A Convenient Solution for Use in Titrating Weldon Muds for Manganese Peroxide.  
J. Soc. Chem. Ind., 8, 968; Jsb. Chem., 1889, 2399; J. Chem. Soc. (Lond.), 58, 448  
Determination of peroxides by use of standard solutions of bichromate and ferrous sulphate
- 1889: 11. McCULLOCH, N. The Volumetric Estimation of Cobalt in Presence of Nickel, Manganese, and other Metals.  
Chem. News, 59, 51; Chem.-techn. Rep., 29, 240; Chem. Ztg., 13, 38, Rep  
Separation from cobalt by the use of sodium acetate and potassium cyanide
- 1889: 12. McCULLOCH, N. The Use of Peroxide of Hydrogen for the Determination of the Metals of the Iron Group.  
Chem. News, 59, 35, Jsb. Chem., 1889, 2395, Chem. Ztg., 13, 26, Rep.  
Criticism of Carnot's article on the action of hydrogen peroxide on the salts of manganese.
- 1889: 13. MOLDENHAUER, F. Kupfervitriol als Indikator beim Titrieren von Zink und Manganese  
Chem. Ztg., 13, 1220; Chem. Centrbl., 1889, 811; Jsb. Chem., 1889, 2407, Ztschr. anal. Chem., 30, 140, Ber., 22, 711, Ref., J. Soc. Chem. Ind., 9, 108; J. Anal. Chem., 3, 429.  
Volumetric determination in presence of zinc, by the use of ferrocyanide

- 1889: 14. NEUMANN, G. Quantitative Bestimmung von Zink neben Mangan.

Ztschr. anal. Chem., **28**, 57; Jsb. Chem., **1889**, 2408; J. Chem. Soc. (Lond.), **56**, 549; J. Soc. Chem. Ind., **8**, 62; J. Anal. Chem., **4**, 69; Chem. Ztg., **23**, 38, Rep.

Separation of zinc as sulphide from a formic acid solution.

- 1889: 15. RADAU, C. Zur Kenntniss vanadinsaurer Salze.

Ann. Chem. (Liebig), **251**, 154.

Separation from vanadium by fusion with sodium carbonate, solution of the fused mass in water, precipitation of hydrated manganese peroxide with alcohol, re-solution in hydrochloric acid, and re-precipitation with hydrogen peroxide and ammonia.

- 1889: 16. REITMAIR, O. Kalkbestimmung bei Gegenwart von Phosphorsäure, Eisen, Thonerde und Mangan.

Ztschr. angew. Chem., **1889**, 358; Ztschr. anal. Chem., **31**, 314.

Separation from calcium by means of oxalates.

- 1889: 17. SCHNEIDER, L. Eine neue Bestimmungsmethode des Mangans.

Oester. Ztschr. Berg- u. Hüttenw., **36**, 608; Chem. Centrbl., **1889**, a, 64; Berg- u. hüttenm. Ztg., **48**, 153; Chem.-techn. Centr. Anz., **1889**, 64; Pharm. Centr., **30**, 189; Chem.-techn. Rep. **28**, a, 240.

Oxidation by bismuth tetroxide and titration with hydrogen peroxide

- 1889: 18. SMITH, E. F. and FRÄNKEL, L. K. Electrolytic Separations.

Chem. News, **60**, 102 and 262; Jsb. Chem., **1889**, 2305; Chem. Ztg., **13**, 257, Rep.; J. Anal. Chem., **3**, 386.

Electrolytic determination in the presence of potassium sulphocyanate.

- 1889: 19. WELLS, J. S. C. and VULTÉ, H. T. A Scheme for the Separation of Al, Cr, Fe, Co, Ni, Mn, Zn, Ba, Ca, Sr, and Mg, in the Presence of Phosphoric, Arsenic, Oxalic, Boric, Silicic, Hydrofluoric, Acetic, and Tartaric Acids, and Organic Matter.

School Mines Quart., **10**, 3; Analyst, **14**, 1888; Ztschr. angew. Chem., **1889**, 681.

Qualitative separation from zinc as sulphide, and detection in the mixed sulphides by fusion with sodium carbonate.

- 1890: 1. BAUMANN, A. Die Analyse des Braunsteins mittels Wasserstoffsuperoxyd.

Ztschr. angew. Chem., **1890**, 72; Jsb. Chem., **1890**, 2442; Chem. News, **63**, 72; Monit. scientif., **35**, 596.

Comments on the Lunge method and also on the Fresenius-Will method. Determination of peroxide by volumetric and gasometric methods. See 1885: 13; 1890: 9; 1890: 10; and 1843: 3.

- 1890: 2. VAN BEMMELN, J. M. Ueber die Bestimmung des Wassers, des Humus, des Schwefels, des in colloidalen Silicaten gebundenen Kieselsäure, des Mangans, u. s. w. im Ackerboden.  
Landw. Vers. Stat., 37, 289; Jsb. Chem., 1890, 2557; J. Chem. Soc. (Lond.), 58, 833.  
Determination in soils. Carnot method. See 1888: 2.
- 1890: 3. BOYD, R. C. The Determination of Manganese and Zinc as Pyrophosphates.  
School Mines Quart., 11, 355; Jsb. Chem., 1890, 2442; J. Soc. Chem. Ind., 9, 973.  
See title.
- 1890: 4. CARNOT, A. (Discussion.)  
Bull. soc. chim. (3), 3, 594; Chem. Ztg., 14, 637; Oester. Ztschr. Berg- u. Hüttenw., 38, 450.  
Precipitation by means of hydrogen peroxide.
- 1890: 5. FRESSENIUS, R. and HINTZ, E. Ueber die Analyse von Chromeisen.  
Ztschr. anal. Chem., 29, 28; Jsb. Chem., 1890, 2440.  
Determination in chromite.
- 1890: 6. HELLMAN, C. G. Determination of Manganese in Iron.  
Eng. Min. J., 50, 593.  
Recommends method of Särnström. See 1881: 15.
- 1890: 7. JENSCH, E. Zur Bestimmung des Zinks in manganhaltigem Flugstaube.  
Chem. Ztg., 13, 465, 726; J. Chem. Soc. (Lond.), 58, 294.  
Separation from zinc by means of hydrogen peroxide.
- 1890: 8. DE KONINCK, L. L. Études sur les procédés d'analyse des matières premières et des produits de la sidérurgie.  
Rev. univers. des mines, 9, 243; Jsb. Chem., 1890, 2436; Chem. News, 62, 19; J. Anal. Chem., 4, 335.  
Separation from iron by means of nitroso- $\beta$  naphthol.
- 1890: 9. LUNGE, G. Ueber die Werthbestimmung des Chorkalks, Braunsteins und Chamäleons auf gasvolumetrischem Wege (mittels des Nitrometers).  
Ztschr. angew. Chem., 1890, 10; J. Soc. Chem. Ind., 9, 21; Jsb. Chem., 1890, 2389; Chem. Ind., 13, 88; Ztschr. anal. Chem., 30, 221; Wagner's Jsb., 36, 560; J. Chem. Soc. (Lond.), 58, 1470.  
Determination of peroxide by means of hydrogen peroxide.
- 1890: 10. LUNGE, G. Zur gasvolumetrischen Analyse durch Wasserstoffsuperoxyd.  
Ztschr. angew. Chem., 1890, 136; Jsb. Chem., 1890, 2444.  
Reply to Baumann's criticisms. See 1890: 1.



- 1890: 11. LUNGE, G. Das Gasvolumeter, ein Apparat zur volligen Ersparung aller Reductionrechnungen bri Ablesungen von Gasvolumen.

Ztschr. angew. Chem., 1890, 139; Ber., 23, 440; Ztschr. anal. Chem., 29, 589.

A modification of the nitrometer. (See 1890: 9.)

- 1890: 12. MCKENNA, A. G. The Precipitation of Manganese as Ammonium Manganous Phosphate.

Tech. Quart., 3, 333; Chem. News, 63, 184; J. Anal. Chem., 5, 140; Iron, 37, 469; Jsb. Chem., 1891, 2479; J. Chem. Soc. (Lond.) 61, 1138; J. Iron Steel Inst., 1891, b, 326; School Mines Quart., 12, 262; Berg- u. hüttenm. Ztg., 50, 186; Eng. Min. J., 51, 635; J. Soc. Chem. Ind., 10, 387; Chem.-techn. Rep., 31, c, 268.

A study of Gibbs method (1867: 3). Comments on Blair method. (1887: 3.)

- 1890: 13. MYHLERTZ, F. G. Method for the Rapid Determination of Manganese in Slags, Ores, etc.

J. Anal. Chem., 4, 267; Chem. Centrbl., 1890, b, 607; Ztschr. anal. Chem., 32, 368; Chem. Ztg., 14, 251, Rep.; Wagner's Jsb., 36, 337; J. Chem. Soc. (Lond.), 60, 366; School Mines Quart., 12, 61; Berg- u. hüttenm. Ztg., 49, 400; Oester. Ztschr. Berg- u. Hüttenw., 39, 13; J. Iron Steel Inst., 1891, a, 444; Techn.-chem. Jahrb., 13, 75.

Fusion with carbonate and nitrate, reduction of manganate with alcohol, solution of precipitate in ferrous sulphate solution, and titration of excess of latter.

- 1890: 14. RIBAN, J. Sur le dosage et la séparation du zinc en présence du fer et du manganèse.

C. R., 110, 1196; Bull. soc. chim. (3), 4, 116; Jsb. Chem., 1890, 2449; Chem. Centrbl., 1890, b, 120.

Separation from zinc by precipitation with sulphuretted hydrogen in feebly acid solution.

- 1890: 15. SELLIK, B. Technische Analyse des Wolframits.

Chem. Ztg., 13, 1474; Ztschr. anal. Chem., 29, 105.

Determination in wolframite.

- 1890: 16. VORTMANN, G. Eine neue Methode zur maassanalytische Bestimmung des Mangans.

Ber., 23, 2801; Jsb. Chem., 1890, 2441; Chem. Centrbl., 1890, b, 676; Ztschr. angew. Chem., 1890, 715; Chem. Ztg., 14, 289, Rep.; J. Chem. Soc. (Lond.), 58, 1470; Chem. News, 62, 251; Bull. soc. chim. (3), 4, 854; Chem. Ind., 14, 214; Wagner's Jsb., 36, 336; J. Iron Steel Inst., 1891, a, 440; School Mines Quart., 12, 61; Oester. Ztschr. Berg- u. Hüttenw., 39, 14; J. Soc. Chem. Ind., 9, 1067; J. Anal. Chem., 4, 57; Chem.-techn. Rep., 30, b, 179.

Precipitation, after the addition of ferric salt, by means of sodium hydroxide and a standard iodine solution, filtration and determination of the iodine in a measured volume of the filtrate

- 1890 17. WARREN, H. N. A Brief Summary of Practical Manipulation.

Chem. News, 61, 63; Ztschr. anal. Chem., 30, 35. Jsb. Chem., 1890, 2372

Use of powdered glass to promote settling of the basic ferric-acetate precipitate.

- 1890 18. ZIEGLER, A. Ueber die analytische Bestimmung der wesentlichen Bestandtheile des metallischen Wolframs, Ferro-Wolframs und Wolframstahles, sowie des Ferrochroms und Chromstahles, unter theilweiser Zugrundelegung neuer Aufschlussverfahren

Dingl. pol. J., 274, 517; 275, 91. Monit. scientif. (4), 4, 486. Jsb. Chem., 1890, 2455; Ztschr. anal. Chem., 30, 47

Determination in tungsten alloys.

- 1891 1. BEHRENS, H. Beitrage zur mikrochemischen Analyse.

Ztschr. anal. Chem., 30, 140.

Detection by microchemical tests with oxalic acid, salt of phosphorus, and potassium chlorate

- 1891 2. BLUM, L. Zur Bestimmung des Mangans im Eisen und Stahl.

Ztschr. anal. Chem., 30, 210; Jsb. Chem., 1891, 2482; Chem. Centrbl., 1891, a 810; J. Chem. Soc. (Lond.), 61, 963; Chem. Ind., 14, 498; Berg- u. huttenm. Ztg., 50, 211; School Mines Quart., 12, 335; Chem. News, 63, 204.

Comments on the Volhard method and the Rürup modification of the same (1891: 26).

- 1891 3. BLUM, L. Ueber eine neue Methode zur volumetrischen Bestimmung des Mangans.

Ztschr. anal. Chem., 30, 284; Jsb. Chem., 1891, 2480; J. Chem. Soc. (Lond.), 61, 1293; J. Iron Steel Inst., 1891, b, 330; Chem. Ztg., 15, 207; Rep., Ber., 24, 841; Ref., Techn.-chem. Jahrb., 14, 34; School Mines Quart., 12, 335; Berg- u. huttenm. Ztg., 50, 276; 51, 41; Eng. Min. J., 53, 88; J. Soc. Chem. Ind., 10, 798; Analyst, 16, 140; Chem.-techn. Rep., 31, c 267

Titration with potassium ferrocyanide in the presence of ammonium tartrate, ferric salts, ammonium chloride, and free ammonia

- 1891: 4. BROWN, D. H. Hints for Beginners in Iron Analysis.  
J. Anal. Chem., **5**, 368 and 374.  
Comments on the Volhard (1879: 14) and Williams (1881: 18) methods of determination.
- 1891: 5. CHEMIKER COMMISSION DER VEREIN DEUTSCHER EISENHÜTTENLEUTE. Manganbestimmung: Bericht über die bisherigen Arbeiten der vom Verein deutscher Eisenhüttenleute eingesetzten Commission zur Einführung einheitlicher Untersuchungsmethoden.  
Stahl u. Eisen, **11**, 373; Chem. Centrbl., **1891**, a, 1003; J. Iron Steel Inst., **1891**, a, 437.  
Discussion of permanganate and chlorate methods. (Wolff, Hampe, Meineke, Reinhardt, Schoeffel and Donath, Ukena.)
- 1891: 6. DONATH, E. Zur analytischen Anwendung von Baryum- und Wasserstoffsuperoxyd.  
Chem. Ztg., **15**, 1085; Jsb. Chem., **1891**, 2393; Chem. Ind., **15**, 189.  
Precipitation by means of hydrogen peroxide. Question of priority.  
See 1891: 11.
- 1891: 7. DONATH, E. Ueber eine "neue" Mangan und Zinktrennung von P. Jannasch und MacGregory.  
Ber., **24**, 3600; Jsb. Chem., **1891**, 2484; J. Chem. Soc. (Lond.), **62**, 384; Bull. soc. chim. (3), **8**, 524.  
Question of priority. See 1891: 11.
- 1891: 8. HAMPE, W. Zur volumetrischen Bestimmung des Mangans.  
Chem. Ztg., **15**, 281.  
Criticism of Moore's statements (1891: 18) regarding the conversion of manganese to phosphate and titration with a ferrous salt.
- 1891: 9. HAMPE, W. Ueber Bestimmung des Mangans nach der Chloratmethode.  
Chem. Ztg., **15**, 1579; Jsb. Chem., **1891**, 2481; Chem. Centrbl., **1892**, a, 182; J. Chem. Soc. (Lond.), **62**, 1132.  
Criticises report of the Chemiker-Commission, 1891: 5.
- 1891: 10. JANNASCH, P. and FRANZEK, C. J. Ueber eine neue quantitative Trennung von Mangan und Nickel, Mangan und Kobalt, und von Mangan, Nickel und Kobalt.  
Ber., **24**, 3204; Jsb. Chem., **1891**, 2484; Chem. Centrbl., **1892**, a, 182; J. Iron Steel Inst., **1892**, a, 493; Chem. News., **64**, 294; Chem. Ztg., **15**, 306, Rep.; Bull. soc. chim. (3), **8**, 277; J. Chem. Soc. (Lond.), **62**, 240; Chem. Ind., **15**, 213; School Mines Quart., **13**, 177; J. Soc. Chem. Ind., **10**, 1037; Analyst, **17**, 58; Chem.-techn. Rep., **31**, b. 297.  
Separations as in title by means of hydrogen peroxide in cyanide solution.

- 1891: 11. JANNASCH, P., and MACGREGORY, J. F. Ueber eine neue quantitative Trennung von Mangan und Zink.

J. prakt. chem. (2), 43, 402; Chem. Centrbl., 1891, a, 1002; J. Chem. Soc. (Lond.), 61, 963; Chem. News, 63, 255; 64, 182; Ztschr. anal. chem., 31, 69; Chem. Ztg., 15, 142, Rep.; Ber. 24, 675, Ref.; School Mines Quart., 12, 337; 13, 75; Eng. Min. J., 52, 386; J. Soc. Chem. Ind., 10, 659; J. Anal. Chem., 5, 659.

Separation by means of hydrogen peroxide.

- 1891: 12. JANNASCH, P., and NIEDERHOFHEIM. Ueber quantitative Metall-scheidungen in alkalischer Lösung durch Wasserstoff-superoxyd.

Ber., 24, 3945; Jsb. Chem., 1891, 2484; Chem. News, 65, 159; Ztschr. angew. Chem., 1892, 83; Chem. Ztg., 16, 13, Rep.; Chem. Ind., 15, 213; Iron, 39, 337.

Separation from zinc by the use of hydrogen peroxide in cyanide solution.

- 1891: 13. LUCKOW, C. Verfahren zur leichten electrolytischen Ausfällung verschiedenen Metalle aus sauren Lösungen.

Chem. Ztg., 15, 740; Jsb. Chem., 1891, 2402.

Electrolytic precipitation upon mercury with formation of an amalgam.

- 1891: 14. LUCKOW, C. Ueber maassanalytische Bestimmungs- und analytische Trennungsmethoden mit Ferro- und Ferricyankalium.

Chem. Ztg., 15, 1491; Chem. Centrbl., 1892, a, 180.

Volumetric determination by means of potassium ferrocyanide.

- 1891: 15. LE ROY, G. A. Sur un nouveau mode de séparation du fer d'avec le cobalt et le nickel.

C. R., 112, 722; Ber., 24, 406, Ref.

Electrolytic precipitation.

- 1891: 16. MOLDENHAUER, F. Abänderung der Manganprobe nach Volhard.

Chem. Ztg., 15, 13; Jsb. Chem., 1891, 2481; Chem. Centrbl., 1891, a, 283; Stahl u. Eisen, 11, 151; Berg. u. hüttenm. Ztg., 50, 75; Chem.-techn. Rep., 31, c, 268.

Modification consists of adding ammonium sulphate, and titrating in the presence of the iron precipitate.

- 1891: 17. MOLDENHAUER, F. Ueber Fehlerquellen beim Titriren des Zinks mit Ferrocyankalium und deren Vermeidung.

Chem. Ztg., 15, 223; Ztschr. anal. chem., 30, 340.

Volumetric determination by means of potassium ferrocyanide.

## 1891: 18. MOORE, T. Volumetric Estimation of Manganese.

Chem. News, 63, 66; Eng. Min. J., 51, 234; Jsb. Chem., 1891, 2479; Chem. Centrbl., 1891, a, 554; J. Chem. Soc. (Lond.), 61, 962; Ztschr. angew. Chem., 1891, 523; Chem. Ztg., 15, 33, Rep.; Ber., 24, 407, Ref.; Bull. soc. chim. (3), 6, 621; Chem. Ind., 14, 498; Wagner's Jsb., 37, 209; Berg- u. hüttenm. Ztg., 50, 185; J. Anal. chem., 5, 237; Chem.-techn. Rep., 31, a, 267.

Volumetric determination by forming manganic metaphosphate, and titrating directly for this compound, with a reducing agent.

## 1891: 19. NORRIS, G. L. Determination of Manganese in Manganiferous Slags and Ores.

J. Anal. Chem., 5, 430; Chem. News, 64, 242; Jsb. Chem., 1891, 2482; Chem. Centrbl., 1892, a, 181; Chem. Ztg., 15, 271, Rep.; Bull. soc. chim. (3), 8, 539; Ztschr. angew. Chem., 1891, 650; J. Iron Steel Inst., 1891, b, 330; J. Chem. Soc. (Lond.), 62, 385; Wagner's Jsb., 37, 209; Berg- u. hüttenm. Ztg., 51, 41; Iron, 38, 449; Chem.-techn. Rep., 31, b, 297; Deutsche chem. Ztg., 1891, 409.

Solution in nitric and hydrofluoric acids, precipitation by potassium chlorate, re-solution of precipitate in oxalic acid or ferrous sulphate solution, and titration for the excess of the reducing agent.

## 1891: 20. NAMIAS, R. Methode zur schnellen Ausführung von Schlacken-Analysen.

Stahl u. Eisen, 11, 579; Jsb. Chem., 1891, 2461; Chem. Centrbl., 1891, b, 493.

Use of Volhard method of determination (1879: 14).

## 1891: 21. PATTINSON, J. and H. S. On the Determination of Manganese in its Ores and Alloys.

J. Soc. Chem. Ind., 10, 333; Jsb. Chem., 1891, 2483; Chem. Centrbl., 1891, a, 1091; J. Chem. Soc. (Lond.), 62, 536; Ztschr. angew. Chem., 1891, 380; Chem. Ind., 14, 498; Wagner's Jsb., 37, 140; School Mines Quart., 12, 335.

Gravimetric and volumetric methods. A study of the ignition of manganese carbonate and of the hydrated peroxide, with reference to gravimetric determinations. Comments on volumetric methods in use at present and a modified form of the Pattinson method. See 1879: 9.

## 1891: 22. REGELSBERGER, F. Zur Werthbestimmung des Aluminiums und seiner Legirungen.

Ztschr. angew. Chem., 1891, 476.

Determination in commercial aluminum.

- 1891: 23. v. REIS, M. A. Ueber Bestimmung von Mangan nach der Chloratmethode  
 Chem Ztg., 15, 1791. Chem Centrbl., 1892, a, 412. Stahl u Eisen, 1891, 375. Ztschr angew Chem., 1891, 377. J Iron Steel Inst., 1892, a, 490  
 Criticism of Hampe's method of determination by means of potassium chlorate (1883: 4)
- 1891: 24. ROSSI, A. J. On Some Methods of Analysis of Iron, Steel, and Cast Iron as Practised in Large Industrial Works  
 Iron Age, 47, 528. J Iron Steel Inst., 1891, a, 443; 1892, a, 491; Stahl u Eisen, 11, 927. Wagner's Jsb., 37, 147.  
 Colorimetric determination with the use of sodium metaphosphate.
- 1891: 25. RUBRICIUS, H. Zur Bestimmung von Mangan in Eisen und Stahl.  
 Chem Ztg., 15, 882. Jsb Chem., 1891, 2481. Chem. Centrbl., 1891, b, 281. J Chem Soc (Lond.), 62, 1030. Wagner's Jsb., 37, 146; Chem-techn. Rep., 31, b, 297. Berg- u. hüttenm. Ztg., 50, 390. Analyst, 16, 180  
 Modification of the Volhard method. Comments on Rurup procedure. See 1879: 14 and 1891: 26
- 1891: 26. RURUP, L. Manganbestimmung in Eisen und Stahl.  
 Chem Ztg., 15, 140 and 186. Jsb Chem., 1891, 2481; Chem Centrbl., 1891, a, 470. J Chem Soc (Lond.), 62, 916. Ztschr. anal. Chem., 30, 242. Wagner's Jsb., 37, 140; J Iron Steel Inst., 1891, b, 326.  
 Modification of Volhard procedure. Addition of sodium sulphate, and titration without filtration. See 1891: 25
- 1891: 27. SMITH, E. F. The Electrolysis of Metallic Phosphates in Acid Solution.  
 Am. Chem. J., 13, 206; Jsb Chem., 1891, 2400.  
 Electrolytic separation from cadmium
- 1891: 28. UKENA. Modificierte Chloratmethode  
 Stahl u Eisen, 11, 381  
 Precipitation by means of potassium chlorate and solution in reducing agent.
- 1892: 1. ALLER. Quick Assay Methods  
 Iron, 40, 382; Berg- u. hüttenm. Ztg., 52, 106; Chem. Centrbl., 1893, a, 858  
 Determination by Volhard procedure. See 1879: 14.
- 1892: 2. BASTIN, C. Dosage du manganèse dans les spieghes et les ferro-manganèses.  
 Monit. scientif. (4), 6, 639. Chem Centrbl., 1892, b, 632. Ztschr. angew. Chem., 1892, 704. Wagner's Jsb., 38, 118. J Iron Steel Inst., 1893, a, 403. Berg- u. hüttenm. Ztg., 52, 59. J Soc Chem Ind., 11, 1037  
 Determination by Williams procedure. See 1881: 18

- 1892: 3. BLUM, L. Zur volumetrischen Bestimmung des Zinks.  
Ztschr. anal. Chem., 31, 60; Berg- u. hüttenm. Ztg., 51, 164.  
Separation from zinc by means of bromine in alkaline solution.
- 1892: 4. CAMPREDON. Dosage du manganèse dans les produits sidérurgiques.  
Rev. chim. indust., 3, 298.  
Separation from iron by the acetate method, and volumetric determination by means of potassium permanganate.
- 1892: 5. CHEMIKER COMMISSION. Manganbestimmung: Erwid-  
erung der Chemiker Commission des Vereins deutscher Eisen-  
hüttenleute auf die Angriffe des Professors Hampe.  
Stahl u. Eisen, 12, 290; Chem. Centrbl., 1892, a, 604; J. Iron Steel  
Inst., 1892, a, 489; Ztschr., angew. Chem., 1892, 275; Wagner's  
Jsb., 38, 120.  
Reply to Hampe, 1892: 9.
- 1892: 6. DENIGES. Natriumhypobromitlösung als Reagens auf  
Mangan. (*Title from Ztschr. anal. Chem.*)  
\* Deutsche-Amerikan. Apotheker Ztg., 11, 75; Ztschr. anal. Chem.,  
31, 316.  
Detection by means of sodium hypobromite.
- 1892: 7. DONATH, E. Bemerkungen zur Vereinbarung einheit-  
licher Untersuchungsmethoden für Eisen und Stahl.  
Chem. Ztg., 16, 141.  
Criticism of report of Chemiker-Commission. See 1891: 5 and  
1892: 5.
- 1892: 8. FREY. Zur mikrochemischen Gesteinsanalyse. (*Title  
from Pharm. Centr.*)  
Schweiz. Wochenschr. Pharm., 30, 149; Pharm. Centr. (N. F.), 13,  
266; Ztschr. anal. Chem., 32, 204.  
Detection by means of microchemical tests.
- 1892: 9. HAMPE, W. Nochmals die Chloratmethode.  
Chem. Ztg., 16, 13; Chem. Centrbl., 1892, a, 457; Ztschr. anorg.  
Chem., 1, 389.  
Criticism of the report of the Chemiker-Commission. See 1892: 5  
and 1892: 7.
- 1892: 10. MOORE, T. The Determination of Cobalt in Manganese  
Ores, and a quick Method for its Estimation.  
Chem. News, 65, 75; 66, 11; Ztschr. anorg. Chem. 1, 392; Ber.,  
25, 444, Ref.  
Separation from cobalt with the aid of citric acid.



- 1892: 11. PRIWOZNIK. Mittheilungen über die im Laboratorium des K. K. General Probieramtes in Wien in den Jahren 1890 und 1891 ausgeführten Analysen und anderweitigen Untersuchungen  
 Berg- u. huttenm. Jahrb., 40, 475; Ztschr. angew. Chem., 1893, 180, Wagner's Jsb., 38, 216.  
 Separation from iron by the acetate method
- 1892: 12. V. REIS, M. A. Zur Bestimmung von Mangan im Eisen.  
 Ztschr. anal. Chem., 31, 604 and 672; Chem. Centrbl., 1892, b, 940, 1893, a, 133; J. Chem. Soc. (Lond.), 64, b, 304; Ztschr. anorg. Chem., 3, 337; Wagner's Jsb., 38, 121; School Mines Quart., 14, 159; Berg- u. huttenm. Ztg., 52, 107; J. Soc., Chem. Ind., 12, 378; Dingt. pol. J., 289, 214.  
 Oxidation of organic matter by the use of barium peroxide. Volumetric determination by the Volhard procedure. See 1887: 4 and 1879: 14.
- 1892: 13. V. REIS, M. A. Ueber Bestimmung des Mangans nach der Chloratmethode.  
 Chem. Ztg., 15, 1791; Stahl u. Eisen, 12, 28; J. Chem. Soc. (Lond.), 62, 1132.  
 Comments on Hampe's article. See 1892: 9.
- 1892: 14. RIGGS, R. B. The Separation of Iron, Manganese, and Calcium by the Acetate and Bromine Methods  
 Am. J. Sci. (3), 43, 135; J. Anal. Chem., 6, 94; Chem. Centrbl., 1892, a, 1004; Ztschr. anorg. Chem., 3, 235; J. Iron Steel Inst., 1893, a, 403; Stahl u. Eisen, 13, 119; J. Chem. Soc. (Lond.), 62, 916; School Mines Quart., 13, 286; J. Soc. Chem. Ind., 12, 183.  
 Separation from iron and calcium as in title.
- 1892: 15. ROTHE, J. W. Trennung des Eisens von anderen Elementen nach einem neuen Verfahren.  
 Mitth. Kgl. Verst. zu Berlin, 10, 132; Iron, 40, 404; J. Iron Steel Inst., 1892, b, 510.  
 Separation from iron by extraction with ether.
- 1892: 16. RUBRICIUS, H. Nachtrag zur modificierten Volhard'schen Manganprobe.  
 Chem. Ztg., 16, 459; Oester. Ztschr. Berg- u. Huttenw., 40, 146; Chem. Centrbl., 1892, a, 829; J. Iron Steel Inst., 1892, b, 512; Ztschr. angew. Chem., 1892, 274; Wagner's Jsb., 38, 118; J. Chem. Soc. (Lond.), 62, 1524; Dingt. pol. J., 285, 286.  
 Experimental data to show accuracy of Volhard procedure (1879: 14).
- 1892: 17. RUBRICIUS, H. Manganbestimmung, mit specieller Berücksichtigung der verschiedenen Eisensorten.  
 Chem. Ztg., 16, 200; Chem. Centrbl., 1892, a, 507; Berg- u. huttenm. Ztg., 51, 163.  
 Determination in irons by the Volhard procedure (1879: 14).

- 1892: 18. RÜDORFF, F. Quantitative Analyse durch Elektrolyse.  
Ztschr. angew. Chem., 1892, 6; Chem. Centrbl., 1892, a, 331; J.  
Chem. Soc. (Lond.), 64, b, 94.  
Determination by electrolysis.
- 1892: 19. SCHNEIDER, L. Beiträge zur chemischen Untersuchung  
des Stahles.  
Oester. Ztschr. Berg- u. Hüttenw., 40, 46 and 235; Chem. Centrbl.,  
1892, a, 337; Ztschr. angew. Chem., 1892, 274 and 466; School  
Mines Quart., 14, 362; Stahl u. Eisen, 12, 471; Wagner's Jsb.,  
38, 119; Berg- u. hüttenm. Ztg., 51, 163; Ztschr. anorg. Chem.,  
1, 474; J. Iron Steel Inst., 1892, b, 512; J. Soc. Chem. Ind. 12,  
293; 13, 546; Dingl. pol. J., 291, 238.  
Determination in steel by oxidation to permanganic acid by means  
of lead peroxide and titration with hydrogen peroxide. Deter-  
mination in chrome steel.
- 1892: 20. VAN GRUNDY, C. P. Note on Textor's Rapid Method for  
the Determination of Manganese.  
Proc. Eng. Soc. Western Penna., 8, 158; J. Iron Steel Inst., 1892,  
b, 512.  
Oxidation to permanganic acid by means of lead peroxide, and  
titration with arsenious acid. (Description of Textor procedure  
is given in this article. No other description has been found.)
- 1892: 21. WARWICK, H. S. Die Elektrolyse von Metall-formiaten.  
Ztschr. anorg. Chem., 1, 298 and 299.  
Electrolytic determination and separation from zinc and cadmium.
- 1893: 1. CARNOT, A. (Discussion.)  
Bull. soc. chim. (3), 9, 214; Chem. Centrbl., 1893, b, 156; Chem.  
News, 68, 15 and 301.  
Comments on the paper by Gorgeu, 1893: 6.
- 1893: 2. CARNOT, A. Sur la precipitation du manganèse par l'eau  
oxygénée et l'ammoniaque, en vue de son dosage pondéral ou  
volumétrique.  
Bull. soc. chim. (3), 9, 613; Chem. Centrbl., 1893, b, 596; Ztschr.  
anorg. Chem., 5, 316.  
See title.
- 1893: 3. CARNOT, A. Sur l'essai des oxydes de manganèse par l'eau  
oxygénée.  
Bull. soc. chim. (3), 9, 646; C. R., 116, 1295; Chem. Centrbl., 1893,  
b, 191; J. Chem. Soc. (Lond.), 64, b, 497; J. Soc. Chem. Ind.,  
12, 897; Ztschr. anorg. Chem., 6, 81.  
Determination by a gasometric method similar to that of Lunge.  
See 1885: 13.

- 1893: 4. CARNOT, A. Sur le dosage du manganèse par les méthodes oxydimétriques

C. R., 116, 1375, Chem Centrbl., 1893, b, 202, Ztschr. anorg Chem., 5, 100 and 249, J. Iron Steel Inst., 1893, a, 530, Chem News, 68, 51, Chem Ztg., 17, 164 and 179, Rep.; Ber., 26, 528 and 728, Ref., School Mines Quart., 15, 55, J. Soc. Chem. Ind., 12, 787, Analyst, 18, 231.

Determination by measurement of the gas evolved when manganese dioxide is titrated with hydrogen peroxide. See 1885: 13, 1890: 1, and 1893: 3

- 1893: 5. CLARK, J. The Use of Sodium Peroxide as an Analytical Agent.

J. Chem. Soc. (Lond.), 63, 1082; Ztschr. anal. Chem., 34, 593.

Separation from zinc, nickel, and cobalt by means of sodium peroxide

- 1893: 6. GORGEU, A. Observation sur le dosage du manganèse par le permanganate de potasse, et sur les permanganates de manganèse de M. Antony Guyard

Bull. soc. chim. (3), 9, 214 and 490, Chem. Centrbl., 1893, b, 155.

J. Iron Steel Inst., 1894, a, 611; J. Chem. Soc. (Lond.), 65, b, 33.

Comments on the procedures of Guyard and Donath. See also 1893: 1, 1863: 2, and 1881: 6

- 1893: 7. HEMPEL, W. Ueber die Anwendung des Natriumsuperoxyds zur Analyse.

Ztschr. anorg. Chem., 3, 103

Detection by means of sodium peroxide

- 1893: 8. JEAN, F. (Discussion.)

Bull. soc. chim. (3), 9, 99, Chem. Centrbl., 1893, a, 665.

See 1893: 9

- 1893: 9. JEAN, F. Dosage du manganèse dans ses minerais et ses alliages

Bull. soc. chim. (3), 9, 248, J. Chem. Soc. (Lond.), 64, b, 498,

School Mines Quart., 14, 362, Ztschr. anorg. Chem., 4, 479

Precipitation by means of sodium carbonate, solution in nitric acid, precipitation by potassium chlorate, and determination as phosphate sulphide, or oxide, also volumetrically by methods of Pattinson, Guyard, Gay-Lussac, and Campredon. Separation from iron by the acetate method. See also 1893: 8.

- 1893: 10. JULIAN, F. Laboratory Notes

J. Am. Chem. Soc., 15, 113, Chem. Centrbl., 1893, b, 393

Precipitation by means of potassium chlorate, and titration with hydrogen peroxide

## 78 BIBLIOGRAPHY OF ANALYTICAL CHEMISTRY OF MANGANESE

- 1893: 11. KOSMAN, B. Zur Trennung von Eisen und Aluminium, Mangan, Zink und Calcium.

Stahl u. Eisen, 13, 431; Chem. Centrbl., 1893, b, 155; J. Chem. Soc. (Lond.), 64, b, 600; Ztschr. anorg. Chem., 4, 397.

Separation from iron by the acetate method and precipitation by Wolff bromine procedure. Comments on Riggs method. See 1892: 14, and 1883: 22.

- 1893: 12. LOW, A. H. Technical Estimation of Manganese in Ores.

J. Anal. Chem., 6, 663; Chem. Centrbl., 1893, a, 665; Chem. News, 67, 162; J. Iron Steel Inst., 1893, a, 418; Ztschr. anorg. Chem., 4, 320; Stahl u. Eisen, 13, 608; Monit. scientif., 43, 207; J. Chem. Soc. (Lond.), 64, b, 438; School Mines Quart., 14, 256; Eng. Min. J., 55, 124.

Determination in ores by precipitation by means of bromine, solution in oxalic acid, and titration with permanganate.

- 1893: 13. PARRY, J., and MORGAN, J. J. The Analysis of Iron and Steel.

Chem. News, 67, 295; Ind. and Iron, 1893, 379; Stahl u. Eisen, 13, 898; School Mines Quart., 15, 64.

Separation from iron by the acetate method, and precipitation by bromine; also colorimetric method and study of Williams method (1881: 18).

- 1893: 14. RÜDORFF, F. Quantitative Analyse durch Elektrolyse.

Ztschr. angew. Chem., 1893, 452.

Electrolytic determination, and separation from copper.

- 1894: 1. CHRISTOMANOS, A. C. Ueber einen neuen Kohlensäurebestimmungs-Apparat.

Ber., 27, 2748; J. Soc. Chem. Ind., 13, 1221.

Modified apparatus for use with the Bunsen method for the determination of the peroxide (1853: 1).

- 1894: 2. CLASSEN, A. Quantitative Analyse durch Elektrolyse.

Ber., 27, 2075; J. Chem. Soc. (Lond.), 66, b, 480; Ztschr. anorg. Chem., 16, 269; Ztschr. Elektrochem., 1, 290.

Determination by electrolysis.

- 1894: 3. FLEITMANN, T. Ueber die quantitative Bestimmung der gewöhnlichsten Beimischungen des im Handel vorkommenden Reinnickels, oder Walznickels.

Ztschr. anal. Chem., 33, 337.

Determination in commercial nickel.

- 1894: 4. JONES, H. C. Sur l'essai des oxydes du manganèse par l'eau oxygénée.  
C.R., 117, 781; Chem. Centrbl., 1894, a, 229; Ber., 27, 33, Ref.; J. Chem. Soc. (Lond.), 66, b, 121.  
Comments on Carnot's articles (1893: 1-4).
- 1894: 5. JONES, J. Rapid Method for the Determination of Manganese in Manganese Bronze.  
J. Am. Chem. Soc., 15, 414; Chem. Centrbl., 1894, a, 108; Ztschr. anal. Chem., 37, 338; Eng. Min. J., 57, 347; Chem.-techn. Rep., 34, a, 297; Monit. scientif., 36, 521; School Mines Quart., 15, 151; Berg- u. hüttenm. Ztg., 53, 189.  
Determination by the Hampe chlorate method (1883: 4).
- 1894: 6. KASSNER, O. Ueber Natriumsuperoxyd und seine Anwendung in der Analyse.  
Arch. Pharm., 232, 226; Ztschr. anal. Chem., 34, 595; J. Chem. Soc. (Lond.), 66, b, 429.  
Separation from chromium by means of sodium peroxide.
- 1894: 7. KIPPENBERGER, C. Ein einfacher Apparat für gasanalytische Zwecke.  
Ztschr. angew. Chem., 1894, 714; Ztschr. anal. Chem., 35, 185.  
Apparatus for gasometric determination of peroxide by measurement of oxygen evolved during reaction with hydrogen peroxide.
- 1894: 8. LUNGE, G. Volumètre à gaz universel.  
Bull. soc. chim. (3), 11, 636.  
Gasometric determination of peroxide.
- 1894: 9. NASS, G. Ueber die quantitative Bestimmung von Mangan, Magnesium, Zink, Kobalt und Nickel, mittels der Oxalathmethode nach Prof. A. Classen.  
Ztschr. angew. Chem., 1894, 501; Chem. Centrbl., 1894, b, 601; Ztschr. anorg. Chem., 7, 364; Chem. Ztg., 18, 227, Rep.; Ber., 28, 22, Ref.; J. Chem. Soc. (Lond.), 66, b, 482; J. Soc. Chem. Ind., 14, 69.  
General study of Classen's method. See 1877: 3 and 7.
- 1894: 10. NEUMANN, G. Quantitative Analyse von Schwermetallen durch Titriren mit Natriumsulfid.  
Monatsh. Chem. 15, 495; J. Chem. Soc. (Lond.), 68, b, 64; Chem. News, 72, 212; Ztschr. anal. Chem., 34, 454.  
Addition of alkaline sulphide in excess, filtration, addition of sulphuric acid in excess, and titration with alkali.
- 1894: 11. POLECK, T. Ueber Natriumsuperoxyd.  
Ber., 27, 1052.  
Separation from chromium by means of sodium peroxide. See 1894: 6.

## 80 BIBLIOGRAPHY OF ANALYTICAL CHEMISTRY OF MANGANESE

- 1894: 12. RÜDORFF, F. Quantitative Analyse durch Elektrolyse.  
Ztschr. angew. Chem., **1894**, 388; J. Chem. Soc. (Lond.), **66**, b, 399.  
Separation from mercury.
- 1894: 13. SANITER, E. H. A Review of Some of the Methods in General Use for the Estimation of Manganese in Minerals and Metals.  
J. Soc. Chem. Ind., **13**, 112; Ber., **28**, 75, Ref.; J. Iron Steel Inst., **1894**, a, 613; J. Chem. Soc. (Lond.), **66**, b, 333; School Mines Quart., **15**, 275; Eng. Min. J., **57**, 155.  
Tests of methods involving precipitation as peroxide by bromine, and as sulphide and phosphate; also Volhard's and Pattinson's methods.
- 1894: 14. SEELIGER, R. Quantitative Trennung von Ferriphosphat, Manganophosphat, Calcium- und Magnesiumphosphat.  
\* Dissertation, Erlangen; Pharm. Centrhl. (2), **14**, 685; Chem. Centrbl., **1894**, a, 107; J. Chem. Soc. (Lond.), **66**, b, 255.  
Determination by permanganate, and by Rössler silver method (1879: 13). Separation from iron by fusion with silica and alkaline carbonates and nitrates.
- 1894: 15. SMITH, E. F., and HEYL, P. Ueber die Verwendung von Quecksilberoxyd bei der Analyse.  
Ztschr. anorg. Chem., **7**, 85, 88, and 89; Ber. **27**, 758, Ref.; Ztschr. anal. Chem., **34**, 74 and 75.  
Separation from iron by means of mercuric oxide.
- 1894: 16. THOMÄLEN, H. Ueber die von Rüdorff empfohlenen Methode der quantitativen Analyse durch Elektrolyse.  
Chem. Ztg., **18**, 1353; Chem. Centrbl., **1894**, b, 667.  
Electrolytic determination. See 1892: 18.
- 1894: 17. ULLMANN, C. Apparat zur Braunsteinbestimmung nach der Bunsen'schen Methode.  
Chem. Ztg., **18**, 478; Chem. Centrbl., **1894**, a, 878; Ztschr. anal. Chem., **37**, 387; Ber., **27**, 524 Ref.; J. Chem. Soc. (Lond.), **68**, b, 88; J. Soc. Chem. Ind. **13**, 979.  
See title and 1888: 5; also 1894: 1.
- 1895: 1. ALVAREZ, P., and JEAN, J. Recherche du zinc, du chrome, du manganèse et du fer.  
Répert. de pharm. **1895**, 440; Chem. Centrbl., **1896**, b, 513; Pharm. Centrhl., **37**, 472; J. Chem. Soc. (Lond.), **72**, b, 600.  
Detection by oxidation to permanganic acid by means of lead peroxide in nitric acid solution.

1895. 2. AUCHY, G. The Volumetric Estimation of Manganese.  
*J Am Chem Soc.* 17, 643. *Chem Centrbl.* 1896, a, 460. *J. Chem. Soc. (Lond.)*, 70, b, 339. *School Mines Quart.* 17, 313. *J. Soc. Chem. Ind.* 15, 220.  
 Criticism and comments on the Williams (1881-18) and the Volhard (1879-14) methods.
1895. 3. BODLANDER, G. Das Gasgravimeter für chemische Analyse auf gasometrischen Wege.  
*Ztschr angew Chem* 1895, 55.  
 Determination of peroxide in pyrolusite (or after precipitation by potassium chlorate from iron), by means of hydrogen peroxide.
1895. 4. CARNOT, A. (Title unknown).  
 \* *Echo Mines* 1895; *Berg- u. hüttenm Ztg.* 1895, 173. *Wagner's Jsb.* 41, 199. \* *Génie civil* 26, 140. *J Iron Steel Inst.* 1895, a, 507.  
 Precipitation with hydrogen peroxide solution of the precipitate in an excess of oxalic acid, and titration for this excess.
1895. 5. ENGELS, C. Vorläufige Mittheilung.  
*Ztschr. anorg. Chem.* 9, 78; *J. Chem. Soc. (Lond.)*, 68, b, 419; *Chem. Centrbl.* 1895, b, 183. *Ber.* 28, 628. Ref.  
 Electrolytic precipitation with the aid of hydrogen peroxide.
1895. 6. ENGELS, C. Quantitative Bestimmung von Mangan und Zink durch Elektrolyse.  
*Ber.* 28, 3182. *Ztschr. Elektrotech. u. Elektrochem.* 2, 413. *Chem. Centrbl.* 1896, a, 327. *Bull. soc. chim. (3)*, 16, 744. *Ztschr. anorg. Chem.*, 12, 400; *Chem. Ztg.*, 20, 44. Rep.; *Ztschr. angew Chem.*, 1896, 76. *J. Chem. Soc. (Lond.)*, 70, b, 276. *J. Soc. Chem. Ind.* 15, 219. *Wagner's Jsb.* 42, 335. *Ann. chim. anal. appl.* 1, 119.  
 Deposition as peroxide from a solution containing much sodium acetate and chrome alum, or a hydroxylamine salt.
1895. 7. FORESTIER, H. Essai des aciers, fers et fontes par l'analyse chimique.  
*Bull. soc. chim. (3)*, 13, 587.  
 Separation from iron by the acetate method or with zinc oxide. Determination by precipitation by means of chlorate or hydrogen peroxide, and ignition to mangano-manganic oxide, or titration with ferrous sulphate or oxalic acid solution; or colorimetric determination by oxidation to permanganic acid by lead peroxide or bismuth tetroxide.
1895. 8. GRÖGER, M. Zur elektrolytischen Bestimmung des Mangans.  
*Ztschr. angew. Chem.*, 1895, 253; *Chem. Centrbl.*, 1895, a, 1190; *School Mines Quart.* 16, 376. *Ztschr. anorg. Chem.*, 11, 69; 12, 400. *Ber.* 28, 567. Ref. *Berg- u. hüttenm. Ztg.* 54, 211; *Chem.-techn. Rep.* 34, 274. *J. Chem. Soc. (Lond.)* 68, b, 419.  
 Criticism of Rudorff electrolytic method. Precipitation by electrolysis and determination as peroxide. See also 1892-18.



- 1895: 9. JANNASCH, P., and v. CLOEDT, E. Ueber quantitative Metalltrennungen in alkalischen Lösung durch Wasserstoff-superoxyd. XI. Die Trennung des Wismuths, Bleis und Mangans von Quecksilber.

Ber., 28, 994; Chem. News, 72, 65; Chem. Centrbl., 1895, b, 64; Bull. soc. chim. (3), 14, 1354; J. Chem. Soc. (Lond.), 68, b, 332; Ann. chim. anal. appl., 1, 75.

Separation from mercury by means of hydrogen peroxide.

- 1895: 10. JANNASCH, P., and v. CLOEDT, E. Ueber quantitative Metalltrennungen in alkalischen Lösung durch Wasserstoff-superoxyd. XIII. Die Trennung des Chroms von Mangan, Eisen und Aluminium.

Ztschr. anorg. Chem., 10, 398; Chem. Centrbl., 1896, a, 220; J. Chem. Soc. (Lond.), 70, b, 222.

Separation from chromium by means of hydrogen peroxide.

- 1895: 11. JANNASCH, P., and v. CLOEDT, E. Ueber die Trennung des Mangans von Zink in ammoniakalischer Lösung durch Wasserstoffsuperoxyd unter Anwendung von Druck.

Ztschr. anorg. Chem., 10, 405; Chem. Centrbl., 1896, a, 221; J. Chem. Soc. (Lond.), 70, b, 220; Chem.-techn. Rep., 34, a, 275.

See title.

- 1895: 12. JANNASCH, P., and KAMMERER, H. Ueber quantitative Metalltrennungen in alkalischen Lösung durch Wasserstoff-superoxyd. XII. Die Trennung des Mangans von Silber und des Wismuth von Kobalt.

Ber., 28, 1407; Chem. Centrbl., 1895, b, 254; Chem. News, 72, 91; J. Chem. Soc. (Lond.), 68, b, 423; J. Soc. Chem. Ind., 14, 1889; Bull. soc. chim. (3), 14, 1273.

Separation from silver by means of hydrogen peroxide.

- 1895: 13. JANNASCH, P., and KAMMERER, H. Ueber quantitative Metalltrennungen in alkalischen Lösung durch Wasserstoff-superoxyd. XIV. Trennung des Arsens von Eisen und Mangan.

Ztschr. anorg. Chem., 10, 408; Chem. Centrbl., 1896, a, 221; J. Chem. Soc. (Lond.), 70, b, 221.

Separation from arsenic by means of hydrogen peroxide.

- 1895: 14. JANNASCH, P., and RÖTTGEN, A. Ueber quantitative Metalltrennungen in alkalischen Lösung durch Wasserstoff-superoxyd. X. Trennung des Wismuths und des Bleies von Cadmium, sowie diejenige des Mangans von Kupfer und Cadmium.

- Ztschr anorg Chem, **8**, 307, 310, and 312, Chem Centrbl., **1895**, a, 1042; Ber., **28**, 435. Ref.: J Chem. Soc (Lond.), **68**, b, 332.  
Separation from copper and cadmium by means of hydrogen peroxide
- 1895**: 15. V. JUPTNER, H. Einige Ursachen der mangelnden Uebereinstimmung bei Manganbestimmungen in Ferromangan  
Oester Ztschr Berg- u Huttenw., **43**, 166; J Iron Steel Inst., **1895**, a, 140, Stahl u Eisen, **15**, 416; Berg- u huttenm Ztg., **54**, 235.  
Variation in the results obtained in the determination in ferromanganese caused in part by variation in atomic weights chosen
- 1895**: 16. NEUMANN, B. Welche electrolytischen Methoden sind in der analytischen Praxis mit Vorteil verwendbar?  
Ztschr. Electrochem., **1895**, 231 and 252. Ztschr anorg Chem., **12**, 399  
General discussion of methods of determination, especially electrolytic methods
- 1895**: 17. REDDROP, J., and RANAGE, H. The Volumetric Determination of Manganese.  
Proc Chem Soc. (Lond.), **1895**, 33; J. Chem. Soc. (Lond.), **67**, 268; Ber., **28**, 652; **29**, 698. Ref.; Chem. Centrbl., **1895**, a, 1042; Wagner's Jsb **42**, 182. J Soc Chem Ind., **14**, 305; Chem News, **71**, 122; Bull soc chim (3) **14**, 1183; School Mines Quart., **17**, 313. J. Iron Steel Inst., **1895**, a, 508  
Comments on Schneider's method. Oxidation with sodium bis-muthate and titration with hydrogen peroxide. See 1889 17
- 1895**: 18. THOMAS, W. S. Methods for the Determination of Manganese  
Bull. Missouri Min Club, **1895**, 35; J Am Chem Soc., **17**, 341; Chem Centrbl., **1895**, a, 1083; J Iron Steel Inst., **1895**, b, 595; Chem Ztg., **19**, 155, Rep.; Bull soc chim (3) **14**, 921; J Chem Soc. (Lond.), **68**, b, 420; School Mines Quart., **16**, 376; Stahl u. Eisen, **15**, 1059; Berg- u huttenm Ztg., **54**, 126  
Criticism of the Low method. Recommends the use of the Volhard method. See 1893 12
- 1895**: 19. ULZER, F., and BRULL, J. Ueber die Manganbestimmung im Roheisen.  
Mitth technol Gen Mus (Wien), **1895**, 312. J. Iron Steel Inst., **1896**, b 442; **1897**, b 497; Chem Ztg., **20**, 36, Rep.; Ztschr angew Chem., **1896**, 78; Wagner's Jsb., **42**, 103; Stahl. u. Eisen, **16**, 633; Berg- u. huttenm Ztg., **55**, 301; J. Soc. Chem. Ind., **15**, 296; Analyst **21**, 139; Chem Centrbl **1897**, a 769; J Chem Soc. (Lond.), **72**, 350; Ann. chim anal. appl., **1**, 135.  
Separation from iron by zinc oxide, precipitation by means of hydrogen peroxide, solution in oxalic acid, and titration for

## 84 BIBLIOGRAPHY OF ANALYTICAL CHEMISTRY OF MANGANESE

the excess of the latter. Discussion of Hampe, Weissmann, and Vortmann articles. See 1883: 4, 1888: 20, and 1890: 16.

- 1896: 1. AUCHY, G. Sources of Error in Volhard's and Similar Methods of Determining Manganese in Steel.

J. Am. Chem. Soc., 18, 498; Chem. Centrbl., 1896, b, 208; Chem. News, 74, 214, 248, and 262; J. Chem. Soc. (Lond.), 70, b, 627; School Mines Quart., 18, 43; Eng. Min. J., 61, 111; J. Soc. Chem. Ind., 15, 677; Analyst, 21, 335.

Sources of error in volumetric and colorimetric determinations. See 1879: 14, and 1896: 15.

- 1896: 2. BURGASS, R. Anwendung des Nitroso- $\beta$ -naphthols in der anorganischen Analyse.

Ztschr. angew. Chem., 1896, 601; J. Chem. Soc. (Lond.), 72, b, 163. Separation from iron, copper, and cobalt by means of nitroso- $\beta$ -naphthol.

- 1896: 3. BÜTTGENBACH, F. Estimation de la valeur du manganèse dans les minerais de fer.

Rev. univers. de mines, 32, 317; Berg- u. hüttenm. Ztg., 55, 368; Oester. Ztschr. Berg- u. Hüttenw., 1896, 65; Wagner's Jsb., 42, 182; J. Chem. Soc. (Lond.), 74, b, 52.

Determination by assay tests on manganese ores.

- 1896: 4. DEWEY, F. P. The Actual Accuracy of Chemical Analysis.

Trans. Am. Inst. Min. Eng., 26, 370; J. Am. Chem. Soc., 18, 808. Determination, and a comparison of the results obtained by various chemists.

- 1896: 5. DUDLEY, C. B. Some Present Possibilities in the Analysis of Iron and Steel.

J. Am. Chem. Soc., 19, 104.

Volumetric determination by precipitation with chlorate and titration with oxalic acid or ferrous sulphate solution in comparison with gravimetric determination as phosphate.

- 1896: 6. ENGELS. Beiträge zur Elektroanalyse der Metalle der Schwefelammoniumgruppe.

Chem. Rundschau, 1896, 5 and 22; Chem. Centrbl., 1897, a, 258; Ztschr. anorg. Chem., 14, 439; J. Chem. Soc. (Lond.), 74, b, 192. Separation from iron and nickel by electrolysis.

- 1896: 7. GIORGIS, G. Sul dosamento del manganese e del cromo nei prodotti siderurgici.

Gazz. chim. ital., 26, b, 528; Chem. Centrbl., 1897, a, 436; Bull. soc. chim. (3), 18, 953; J. Iron Steel Inst., 1897, b, 498; J. Chem. Soc. (Lond.), 72, b, 350.

Determination by addition of the solution to an excess of potassium permanganate and titration for the excess with a solution of chromium sulphate.

- 1896: 7a. HANDY, J. O. Aluminium Analysis.  
J. Am Chem Soc, 18, 766, Ann chim anal. appl. 2, 90.  
Determination in aluminium-manganese alloys by the Williams method
- 1896: 8. JANNASCH, P. Ueber Trennungen des Mangans von Kupfer und Zink (Wasserstoffsperoxyd Methode), sowie des Kupfers von Zink und Nickel (Schwefelwasserstoff und Rhodanmethode) nebst ergänzenden Bemerkungen  
Ztschr. anorg Chem., 12, 134; Chem. Centrbl. 1896, b, 208, J. Chem. Soc. (Lond.), 70, b, 546, Ber., 29, 696, Ref. Analyst, 22, 80.
- 1896: 9. JANNASCH, P., and LEHNERT, H. Ueber quantitative Metalltrennungen in alkalischer Lösung durch Wasserstoffsperoxyd. XV. Trennungen in natronalkalischer Lösung  
Ztschr. anorg Chem. 12, 126. Chem. Centrbl. 1896, b, 209, J. Chem. Soc. 70, b, 547; Ber., 29, 695, Ref.  
Separation from cobalt and nickel by means of hydrogen peroxide in alkaline potassium cyanide solution
- 1896: 10. V. JUPTNER, H. Einige Ursachen der mangelnden Uebereinstimmung bei Manganbestimmungen im Ferromangan  
Oester. Ztschr. Berg- u. Hüttenw., 44, 15; Chem. Centrbl., 1896, a, 513; Chem. Ztg., 20, 52, Ref. Analyst, 22, 196  
Criticism of methods of standardizing permanganate solutions
- 1896: 11. MIGNOT, A.  
\* Rev. chim. anal. appl., 4, 319 and 390, Chem. Ztg., 20, 234 and 275, Rep.  
Separation from iron with ammonium succinate, precipitation with chlorate, and re-precipitation with bromine or salt of phosphorus. Also colorimetric determination by oxidation by means of lead peroxide or bismuth tetroxide in nitric acid solution.
- 1896: 12. MIXER, C. T., and DUBOIS, H. W. Sarnstrom's Method of Determining Manganese in Iron Ores.  
J. Am. Chem. Soc., 18, 385; Chem. Centrbl., 1896, a, 1082; Chem. News, 75, 51, J. Chem. Soc. (Lond.), 70, b, 547; Bull. soc. chim. (3), 16, 1416; J. Iron Steel Inst., 1896, b, 448; School Mines Quart., 18, 43, Ann. chim. anal. appl., 1, 196  
Determination by the Swedish method as modified by Sarnström. See 1881: 15
- 1896: 13. MURKEWITSCH, M. Bestimmung des Mangans in Gusseisen, Stahl, Eisen und dergl. (Title from Chem. Ztg.)  
\* Gornij. J., 1896, 396; Chem. Ztg., 20, 220, Rep.; Oester. Ztschr. Berg- u. Hüttenw., 46, 53.  
Determination by the Volhard method See 1870: 14

## 86 BIBLIOGRAPHY OF ANALYTICAL CHEMISTRY OF MANGANESE

- 1896: 13a. NEUMANN, B. Die elektrolytische Bleibestimmung u. ihre Beeinflussung durch die Gegenwart von Arsen, Selen, Mangan.

Chem. Ztg., 20, 383.

Separation from lead by electrolysis.

- 1896: 14. RÜRUP, L. Vergleichende Manganbestimmungen in Stahl und Eisen.

Chem. Ztg., 20, 285 and 337; Chem. Centrbl., 1896, a, 1144 and 1178; Ztschr. anorg. Chem., 15, 383; Berg- u. hüttenm. Ztg., 55, 216; Analyst, 21, 218; J. Iron Steel Inst., 1896, a, 535.

Comparative determinations as manganous sulphate, as manganomanganic oxide, by removal of the iron with sodium sulphate and titration with permanganate, by the Ford, the Volhard, and the Hampe chlorate methods. See 1881: 8, 1879: 14, and 1883: 4.

- 1896: 15. STONE, G. C. Remarks on Mr. Auchy's Paper on the Volumetric Determination of Manganese.

J. Am. Chem. Soc., 18, 228; Chem. Centrbl., 1896, a, 1028; Bull. soc. chim. (3), 16, 1238; J. Iron Steel Inst., 1896, b, 443; J. Chem. Soc. (Lond.), 70, b, 547; School Mines Quart., 18, 43.

Recommends the Volhard method with slight modification. See 1896: 1.

- 1896: 16. TAGGART, W. T., and SMITH, E. F. The Separation of Manganese from Tungstic Acid.

J. Am. Chem. Soc., 18, 1053; Chem. Centrbl., 1897, a, 309; Chem. News, 75, 26; Chem. Ztg., 21, 10, Rep.; Bull. soc. chim. (3), 18, 626; J. Chem. Soc. (Lond.), 72, b, 433; J. Soc. Chem. Ind. 16, 164. Inadvisability of using ammonium sulphide or alkaline carbonates in effecting a separation from tungstic acid.

- 1896: 17. VIARD, G. Sur le dosage du manganèse en présence de l'acid phosphorique.

Bull. soc. chim. (3), 15, 973; Chem. Centrbl., 1896, b, 600; J. Chem. Soc. (Lond.), 72, b, 519; J. Soc. Chem. Ind., 15, 677; Ann. chim. anal. appl., 1, 332.

Inapplicability of the Hannay, and the Beilstein and Jawein method of determination, in the presence of phosphoric acid. See 1877: 10 and 1879: 1.

- 1897: 1. AUCHY, G. A Method for the Complete Analysis of Iron Ores, with Notes on Särnström's Method of Determining Manganese.

J. Am. Chem. Soc., 19, 139; Chem. Centrbl., 1897, a, 883; J. Iron Steel Inst., 1898, a, 539; J. Chem. Soc. (Lond.), 72, b, 603.

Comments on Särnström's method. See 1881: 15.

- 1897 2. VAN BEMMELEN, J. M. Beiträge zur Analyse der Ackerböden. (*Title from Ztschr anal. Chem.*)  
 \* Landw Vers -Stat., 37, 270. Ztschr anal Chem, 36, 799  
 Determination in soils by the Carnot method See 1888 2.
- 1897 3. BREARLEY, H. The Estimation of Manganese in Spiegels. Chem News 75, 13. Chem Centrbl 1897, a, 335. Bull soc chim. (3), 18, 1300; J Iron Steel Inst, 1897, b, 498; J Chem. Soc. (Lond ), 72, b, 233.  
 Application of Wright and Menke's modification of Guyard's method to the determination of manganese in the filtrate from the acetate separation. See 1886 17 and 18
- 1897 4. BREARLEY, H. Separation with Alkaline Acetates. Chem News 76, 165. Chem. Centrbl., 1897, b, 911. J. Chem Soc. (Lond ), 74, b, 96.  
 Separation from iron by the acetate method.
- 1897 5. CUSHMAN, A. R. A New and Rapid Method for the Qualitative Separation of Iron, Aluminium, Chromium, Manganese, Zinc, Nickel, and Cobalt.  
 Am Chem J, 19, 606. Chem Centrbl, 1897, b, 434. J. Chem. Soc. (Lond ) 72, b, 518. Ann chim anal appl, 3, 20.  
 Qualitative detection and separation Use of bromine in connection with alkaline hydroxides.
- 1897 6. DEVISSE, N. De la calcination des minerais manganésifères carbonates.  
 Rev. univ. des mines (3), 39, 1897; Chem News, 76, 212; J. Chem. Soc (Lond ), 74, b, 142  
 Volumetric determination by the Volhard method.
- 1897 7. ENGELS, C. Quantitative Bestimmung von Mangan durch Elektrolyse.  
 Ztschr Elektrochem, 3, 286 and 305. Chem. Centrbl., 1897, a, 308 and 436 Ztschr anorg Chem 14, 438. Chem Ztg, 21, 40. Rep; J Chem Soc (Lond ), 74, b, 52 J Soc Chem Ind., 16, 262; Dingl pol J, 304, 262.  
 See title.
- 1897 8. GRANGER, A. Sur les phosphures de chrome et de manganèse  
 C. R., 124, 190; Chem. News, 75, 95.  
 Determination as sulphide in chromium and manganese phosphides.
- 1897 8a. HILLEBRAND, W. F. Some Principles and Methods of Analysis Applied to Silicate Rocks.  
 Bull. U. S. Geol. Surv. No. 148, 41; Chem. News, 78, 80.  
 Separation from cobalt, nickel, and copper by solubility of sulphides in hydrochloric acid. Precipitation as carbonate and ignition to oxide. Comments on Jannasch and Cloedt's separation from zinc See 1895 11

## 88 BIBLIOGRAPHY OF ANALYTICAL CHEMISTRY OF MANGANESE

### 1897: 9. JULIAN, F. Manganbestämningsmetod.

Jern.-Kont. Ann., 52, 118; Berg.- u. hüttenm. Ztg., 56, 410; J. Iron Steel Inst., 1898, b, 557; Chem. Ztg., 21, 313, Rep.; J. Soc. Chem. Ind., 17, 185; Ann. chim. anal. appl., 3, 56.

Precipitation by chlorate in the presence of nitric acid, solution of the precipitate in an excess of hydrogen peroxide, and titration for this excess with permanganate.

### 1897: 10. LONGI, A., and CAMILLA, S. Intorno alla determinazione del manganese nelle soluzioni manganose e permanganiche.

Gazz. chim. ital., 27, a, 97; Chem. Centrbl. 1897, a, 619; Ztschr. anorg. Chem., 17, 158; 18, 403; Bull. soc. chim. (3), 18, 952; J. Chem. Soc., 72, b, 387.

Modification of the Volhard method (1879: 14).

### 1897: 11. LEMAIRE, M. Dosage colorimétrique du manganèse.

\* Bull. soc. pharm. Bordeaux, 1897, 268; Chem. News, 76, 219; Ann. chim. anal. appl., 2, 409.

Colorimetric method, determination in plants. Oxidation to permanganic acid in nitric acid solution by means of lead peroxide.

### 1897: 12. MILLER, E. H. Notes on the Ferrocyanides of Zinc and Manganese.

J. Am. Chem. Soc., 18, 1100; Chem. Centrbl., 1897, a, 283; Chem. News, 75, 186.

Volumetric determination as ferrocyanide.

### 1897: 13. MILLER, E. H., and MATHEWS, J. A. On the Ferrocyanides of Zinc and Manganese.

J. Am. Chem. Soc., 19, 547; Chem. Centrbl., 1897, b, 538.

Volumetric determination as ferrocyanide.

### 1897: 14. PURGOTTI, A. Supra un nuovo metodo di determinazione di alcune sostanze per mezzo del solfato d'idrazina.

Gazz. chim. ital., 26, b, 568; Chem. Centrbl., 1897, a, 488; Ztschr. anorg. Chem., 18, 403; Pharm. Centrbl., 1897, 551; Ann. chim. anal. appl., 2, 414.

Gasometric determination, with the aid of hydrazine-sulphate.

### 1897: 15. SCHNEIDER, L. Ein Beitrag zu den vergleichenden Manganbestimmungen in Stahl und Eisen von L. Rürup.

Chem. Ztg., 21, 41; Chem. Centrbl., 1897, a, 436; J. Iron Steel Inst., 1898, a, 534; J. Chem. Soc. (Lond.), 74, b, 94; Analyst, 22, 110.

Comments on Rürup's comparative determinations. See 1896: 14. Reference to colorimetric methods by oxidation to permanganic acid.



- 1897: 16. STONE, G. C., and VAN INGEN, D. A. The Ferrocyanides of Zinc and Manganese.  
J. Am. Chem. Soc., 19, 542. Chem. Centrbl. 1897, b, 538.  
Volumetric determination as ferrocyanide
- 1897: 17. WYNKOOP, G. Qualitative Separations with Sodium Nitrite in Absence of Phosphates.  
J. Am. Chem. Soc., 19, 434. J. Chem. Soc. (Lond.), 74, b, 54.  
Separation from iron by means of sodium nitrite.
- 1898: 1. AUSTIN, M. On the Estimation of Manganese Separated as the Carbonate.  
Am. J. Sci. (4), 5, 382; Ztschr. anorg. Chem., 17, 272; Chem. Centrbl., 1898, b, 65; Chem. News 77, 243. 78, 240; Ztschr. angew. Chem., 1898, 581 and 1131; Chem. Ztg., 22, 212. Rep. Wagner's Jsb., 44, 121; Chem.-techn. Rep., 37, 610; J. Chem. Soc. (Lond.), 74, b, 646; School Mines Quart., 20, 303.  
Precipitation as carbonate and determination as the oxide or the sulphate.
- 1898: 2. BIALOBSZCZSKI, M. Die Anwendung saurer Lösungen von arseniger Säure in der Maassanalyse. (*Title from Ztschr. anal. Chem.*).  
\* Pharm. Ztschr. f. Russland, 35, 785; Ztschr. anal. Chem., 37, 445  
Determination of manganese peroxide by the use of arsenious acid.
- 1898: 3. BREARLEY, H. Separations from Chromic Acid. II. The Separation of Manganese  
Chem. News, 77, 131; Chem. Centrbl., 1898, a, 961; J. Chem. Soc., 74, b, 409  
Separation from chromic acid by the use of sodium carbonate in cold solution and by the use of sodium hydrogen phosphate
- 1898: 4. CAMPREDON, L. Sur le dosage rapide des principaux éléments des produits sidérurgiques.  
Rev. chim. indust., 9, 306.  
Comparison of the Schneider method with the Volhard method.  
See 1885 15. and 1879 14
- 1898: 4a. DENIGES. Réactions de quelques métaux de groupe du fer en milieu glycérimé  
\* Bull. soc. pharm. Bordeaux, 1898, 97. Ann. chim. anal. appl., 3, 230.  
Detection in the presence of cobalt and nickel by means of reactions occurring in alkaline solutions containing glycerine.

- 1898: 5. ENGEL, C. Analyse électrolytique, dosage des métaux précipitables par le sulphure ammonique.

L'Éclairage électrique, 14, 106; Chem. Centrbl. 1898, b, 557; Ztschr. Elektrochem., 5, 37; School Mines Quart., 20, 302; J. Soc. Chem. Ind., 17, 796.

Electrolytic separation from iron, cobalt, and nickel.

- 1898: 6. FORD, A. P., and BREGOWSKY, J. M. Use of Hydrofluoric Acid in the Determination of Manganese in Iron and Ores.

J. Am. Chem. Soc., 20, 504; Chem. Centrbl., 1898, b, 508; Chem. Ztg., 22, 198, Rep.; Bull. soc. chim. (3), 22, 9; Chem.-techn. Rep. 37, 610; Wagner's Jsb., 44, 121; J. Chem. Soc. (Lond.), 74, b, 540; School Mines Quart., 20, 303; J. Soc. Chem. Ind., 17, 796; Analyst, 23, 303.

Use of hydrofluoric acid to hold the silica in solution when precipitating manganese peroxide by the Williams method (1881: 18).

- 1898: 7. GOOCH, F. A., and AUSTIN, M. The Estimation of Manganese as the Sulphate and as the Oxide.

Am. J. Sci. (4), 5, 209; Ztschr. anorg. Chem., 17, 264; Chem. Ztg., 22, 212, Rep.; Chem. Centrbl., 1898, b, 1150; J. Chem. Soc. (Lond.), 74, b, 646; J. Iron Steel Inst., 1898, b, 558; Chem. News, 77, 255; Bull. soc. chim. (3), 20, 694; Wagner's Jsb., 44, 121; Eng. Min. J., 65, 585; Chem.-techn. Rep., 37, 610.

Determination as sulphate and as oxide.

- 1898: 8. GOOCH, F. A., and AUSTIN, M. On the Determination of Manganese as the Pyrophosphate.

Am. J. Sci. (4), 6, 233; Ztschr. anorg. Chem., 18, 339; Chem. Centrbl., 1899, a, 378; Chem. News, 78, 239 and 246; Chem. Ztg., 22, 319, Rep.; Bull. soc. chim. (3), 22, 197; Wagner's Jsb., 44, 122; J. Chem. Soc. (Lond.), 76, 128; School Mines Quart., 20, 303 and 400; Analyst, 24, 52.

Study of the proper conditions for precipitation as phosphate.

- 1898: 9. GOOCH, F. A., and AUSTIN, M. On the Condition of Oxidation of Manganese Precipitated by the Chlorate Process.

Am. J. Sci. (4), 5, 260; Ztschr. anorg. Chem., 17, 253; Chem. Centrbl., 1898, a, 1203; Ztschr. angew. Chem., 1898, 664; Chem. News, 77, 269 and 279; Chem. Ztg., 22, 212, Rep.; Wagner's Jsb., 44, 121; J. Chem. Soc. (Lond.), 74, b, 645; School Mines Quart., 20, 303; J. Soc. Chem. Ind., 17, 796.

Precipitation with sodium chlorate and solution of the oxide in a sulphuric acid and potassium iodide solution, and titration for the liberated iodine with thiosulphate; or reduction of the oxide with arsenious acid and titration of the excess of that reagent.

- 1898: 10. DE GRAMONT, A. Analyse spectrale de quelques minéraux non conducteurs par les sels fondus et réactions des éléments.  
C. R., 126, 1513; J. Chem. Soc. (Lond.), 74, b, 636.  
Detection by spectrum analysis.
- 1898: 11. HILLEBRAND, W. F. See 1897: 8a.
- 1898: 12. JANNASCH, P., and ALFFERS, F. Ueber quantitative Metalltrennungen in ammoniakalischer und saurer Lösung durch Hydroxylamin und durch Hydrazin. (II) Die Trennung des Quecksilbers von Molybdän und Wolfram, sowie von den Metallen der Schwefelammoniumgruppe.  
Ber., 31, 2383; J. Chem. Soc. (Lond.), 76, b, 60.  
Separation from mercury.
- 1898: 13. KAEPPEL, F. Zur quantitative Bestimmung des Mangans und Trennung des Eisens von Mangan durch Elektrolyse.  
Ztschr. anorg. Chem., 16, 268; Chem. Centrbl., 1898, a, 962; Ztschr. angew. Chem., 1898, 435; Chem. Ztg., 22, 118, Rep.; Chem. News, 77, 201; 79, 195; Bull. soc. chim. (3), 22, 811; Chem.-techn. Rep., 37, 287 and 610; Oester. chem. Ztg., 1, 13; Ztschr. Elektrochem., 1898, 41; Wagner's Jsb., 44, 287; J. Chem. Soc. (Lond.), 74, b, 354; School Mines Quart., 19, 430; 20, 400; J. Soc. Chem. Ind., 17, 605; Analyst, 23, 221; Dingl. pol. J., 310, 16.  
Deposition from faintly acid solution partly as metal and partly as peroxide.
- 1898: 14. LEHNKERING, P. Untersuchung von Eisenerzen. (*Title from Wagner's Jsb.*).  
\* Ztschr. öffentlich. Chem., 1898, 459; Wagner's Jsb. 44, 120; J. Soc. Chem. Ind., 17, 951; J. Chem. Soc. (Lond.), 76, 251.  
Recommends the Volhard-Wolff method for determination in ores.  
Comments on the Hampe method. See 1884: 18, and 1883: 4.
- 1898: 15. MURMANN, E. Bemerkungen zur Bestimmungen des Zinks und Mangans als Sulfid.  
Wien. Akad. Ber. (2b), 107, 434; Monatsh. Chem., 19, 404; Chem. Centrbl., 1898, b, 1035; Analyst, 24, 51; Ann. chim. anal. appl., 4, 203.; J. Soc. Chem. Ind., 17, 1186; J. Chem. Soc. (Lond.), 76, 126; Chem. News, 81, 60.  
Addition of mercuric chloride, precipitation of mercuric sulphide and manganous sulphide together, and expulsion of the mercuric sulphide by the ignition of the precipitate, in presence of hydrogen, in a special form of crucible.
- 1898: 16. MURMANN, E. Bemerkungen zur Analyse von Schmiedeeisen.  
Oester. chem. Ztg., 1, 383; Chem. Centrbl. 1898, b, 1282; School Mines Quart., 20, 303.  
Gravimetric determination as sulphide.

- 1898: 17. NOTHOMB, M. Apparat zur Werthbestimmung des Braunsteins. -

Chem. Ztg., **22**, 80; Chem. Centrbl., **1898**, a, 631; Analyst, **23**, 111.  
Determination by loss of weight on treatment with oxalic acid.

- 1898: 18. PICHARD, P. Recherche et dosage rapide du manganèse dans les plantes et les terres végétates par une méthode colorimétrique.

C. R., **126**, 550; Chem. Centrbl., **1898**, a, 753; Chem. News, **77**, 108; Chem.-techn. Rep., **37**, 286; J. Soc. Chem. Ind., **17**, 273; Ann. chim. anal. appl., **3**, 123.

Oxidation in a nitric acid solution by means of lead peroxide.

- 1898: 19. PICHARD, P. Contribution à la recherche du manganèse dans les minéraux, les végétaux et les animaux.

C. R., **126**, 1882; Chem. Centrbl., **1898**, b, 381; J. Soc. Chem. Ind., **17**, 807; School Mines Quart., **19**, 429; J. Chem. Soc. (Lond.), **76**, 40.

Detection by colorimetric test. See also 1898: 18.

- 1898: 20. VITALI, D. Ueber den Nachweis des Mangans. (*Title from Chem. Centrbl.*).

\* Boll. chim. Farm., **37**, 545; Chem. Centrbl., **1898**, b, 942; J. Chem. Soc. (Lond.), **76**, 251; Ann. chim. anal. appl., **3**, 408.

Detection by the use of bromates in a sulphuric acid solution.

- 1898: 21. WOLMAN, L. Beitrag zur quantitativen Elektrolyse von Schwermetallen.

Ztg. Elektrochem., **3**, 537; J. Chem. Soc. (Lond.), **74**, b, 50.

Influence of an oxalate, pyrophosphate, or acetic acid on the results obtained by electrolytic deposition from nitric-acid solution.

- 1899: 1. BREARLEY, H. The Estimation of Manganese by means of Potassium Permanganate.

Chem. News, **79**, 47 and 83.

A query on Mr. Daw's article on the Volhard process (1899; 4).

- 1899: 2. BREARLEY, H. Iron Separations with Alkaline Salts.

Chem. News, **79**, 193; J. Chem. Soc. (Lond.), **76**, 815.

Separation from iron by the acetate method.

- 1899: 3. BREARLEY, H. A Bibliography of Steel Works Analysis.

Chem. News, **80**, 233, 245, 257, 271.

A compilation of references from the Chemical News, 1860-1899, Journal of the Chemical Society (London), 1885-1898, and the Journal of the Iron and Steel Institute, 1880-1899, bearing on manganese in its relations to iron and steel analysis.

- 1899: 4. DAW, F. W. The Estimation of Manganese by Means of Potassium Permanganate.  
Chem. News, **79**, 25, 58, and 104; Chem. Centrbl., **1899**, a, 504; Ztschr. angew. Chem. **1899**, 279; Chem. Ztg., **23**, 44, Rep.; Bull. soc. chim. (3), **22**, 443; J. Iron Steel Inst. **1899**, a, 465; Chem.-techn. Rep., **38**, 272; Wagner's Jsb., **45**, 130; School Mines Quart., **20**, 302; Analyst, **24**, 110; J. Chem. Soc. (Lond.), **76**, 334.  
Criticism of the Volhard method (1879: 14).
- 1899: 5. DUNNINGTON, F. P. Composition of Manganese Pyrophosphate.  
Chem. News, **79**, 275.  
A notice of an error in "Fresenius Quantitative Analysis" (1876, Vol. 1).
- 1899: 6. FERNBERGER, H. M., and SMITH, E. F. The Electrolysis of Metallic Phosphate Solutions.  
J. Am. Chem. Soc., **21**, 1001.  
Electrolytic separation from copper.
- 1899: 7. FRIEDHEIM, C., and BRÜHL, E. Kritische Studien ueber die Anwendung des Wasserstoffsperoxyds in der quantitativen Analyse.  
Ztschr. anal. Chem., **38**, 686; J. Soc. Chem. Ind., **19**, 170.  
Criticism of the work done by Jannasch regarding the use of hydrogen peroxide for the separation from copper, zinc, nickel, and chromium. See 1895: 10, 11, and 14, and 1896: 8 and 9.
- 1899: 8. HERTING, O. Beitrag zur Bestimmung des Kohlenstoffs, des Kupfers und Mangans im Eisen.  
Ztschr. angew. Chem. **1899**, 1193; Chem. Centrbl., **1900**, a, 226; Wagner's Jsb., **45**, 129.  
Preference given to the Gooch-Austin and the Volhard-Wolff methods. See 1898: 8 and 1884: 18.
- 1899: 9. HESS, W. H., and CAMPBELL, E. D. A New Method for the Direct Determination of Alumina in the Presence of Iron, Manganese, Calcium, and Magnesium.  
J. Am. Chem. Soc., **21**, 776; J. Chem. Soc. (Lond.), **78**, 50; Ann. chim. anal. appl., **5**, 230.  
Separation from aluminum by means of phenylhydrazine.
- 1899: 10. NAMIAS, R. Volumetric Estimation of Manganese. (*Title from J. Chem. Soc.*)  
\* Ann. Soc. chim. Melano, **1899**, 54; Chem. Centrbl., **1899**, a, 1224; J. Iron Steel Inst., **1900**, a, 433; J. Chem. Soc. (Lond.), **78**, 50.  
Use of the Volhard method (1879: 14).

## 94 BIBLIOGRAPHY OF ANALYTICAL CHEMISTRY OF MANGANESE

- 1899: 11. NATTERER, K. Chemische Untersuchungen im Rothen Meere.  
 Monatsh. Chem., **20**, 12.  
 Colorimetric determination in the water of the Red Sea.
- 1899: 12. POZZI-ESCOT, M.-E. Analyse microchimique.  
 Ann. chim. anal. appl., **4**, 398.  
 Detection by microchemical tests.
- 1899: 13. REICHARD, C. Ueber die maassanalytische Bestimmung des Mangans in den mangansauren Salzen durch alkalische Lösungen von arseniger Säure.  
 Chem. Ztg., **23**, 801; Chem. Centrbl., **1899**, b, 886; J. Soc. Chem. Ind., **18**, 1156; J. Chem. Soc. (Lond.), **76**, b, 813; Chem. News, **82**, 308.  
 See title.
- 1899: 14. REICHARD, C. Ueber die quantitative Bestimmung der Mangansäure in Gegenwart von Mangansalzen, bzw. die Analyse der beiden Manganverbindungen neben einander mittels arseniger Säure in alkalischer Lösung.  
 Chem. Ztg., **23**, 867; Chem. Centrbl., **1900**, a, 66; J. Chem. Soc. (Lond.), **78**, 109; Ann. chim. anal. appl., **5**, 394; Analyst., **25**, 23.  
 See title.
- 1899: 15. RIEDERER, E. J. Electrolytic Determination of Zinc in the Presence of Manganese.  
 J. Am. Chem. Soc., **21**, 789; J. Chem. Soc. (Lond.), **78**, 49; Ann. chim. anal. appl., **5**, 266; Analyst, **25**, 79.  
 Separation from zinc by electrolysis.
- 1899: 16. J. T. Manganese in Chrome Steels.  
 Chem. News, **79**, 157.  
 Note on the Ford-Williams method (1881: 18).
- 1900: 1. BÖTTGER, W. Ueber die Bestimmung des Mangans als Pyrophosphat.  
 Ber., **33**, 1019; Chem. Centrbl. **1900**, a, 1140; J. Soc. Chem. Ind., **19**, 564; Chem. News, **82**, 247; J. Chem. Soc. (Lond.), **78**, 443; Analyst, **25**, 304.  
 Full discussion of the conditions which give the best results in the determination as pyrophosphate.
- 1900: 2. DAKIN, H. D. Zur Bestimmung von Mangan und Kobalt als Phosphat.  
 Ztschr. anal. Chem., **39**, 784.  
 Precipitation in the presence of a moderate excess of ammonium chloride and determination by weighing as ammonium manganese phosphate or the pyrophosphate. Comments on the article by Gooch and Austin. See 1898: 8.

- 1900: 3. HILLEBRAND, W. F. Some Principles and Methods of Rock Analysis.

Bull. U. S. Geol. Surv., No. 176, 60.

Separation from nickel and cobalt by means of the solubility of their sulphides. Precipitation as carbonate. Comments on the Jannasch and Cloedt method of separation from zinc by means of hydrogen peroxide. See 1895: 11 and 1899: 7.

- 1900: 4. HIORNS, A. The Electrolytic Estimation of Manganese in Manganese Ores.

Chem. News, 81, 15; Chem. Centrbl., 1900, a, 489; J. Chem. Soc. (Lond.), 78, 444; Ann. chim. anal. appl., 5, 230; School Mines Quart., 22, 94.

Precipitation by electrolysis and ignition to mangano-manganic oxide.

- 1900: 5. IBBOTSON, F., and BREARLEY, H. The Estimation of Manganese and Chromium in Tungsten Alloys.

Chem. News, 82, 209; Chem. Centrbl., 1900, b, 1188; Chem. Ztg., 24, 347, Rep.

Volumetric determination by oxidation to permanganate by means of lead peroxide in nitric acid solution, and titration with a reducing agent. Hydrofluoric acid used to aid in the solution of the alloy. (See also Norris, 1891: 19, and Ford and Bregowsky, 1898: 6).

- 1900: 6. IBBOTSON, F., and BREARLEY, H. The Estimation of Molybdenum in Steel and Steel-making Alloys.

Chem. News, 81, 269; School Mines Quart., 22, 97.

Influence of molybdenum on the determination of manganese by means of bromine and by the Williams-Ford method (1881: 18).

- 1900: 7. JERVIS, H. Note on the Estimation of Manganese in Steel.

Chem. News, 81, 171; Chem. Centrbl., 1900, a, 1038; J. Chem. Soc. (Lond.), 78, 444; Stahl u. Eisen, 20, 747; School Mines Quart., 22, 94.

Determination in molybdenum powders and in tungsten steels by oxidation to permanganate by means of lead peroxide in nitric acid solution, and titration with oxalic acid or ferrous sulphate.

- 1900: 8. JOÛET, C. H. The Analysis of Slags and Cinders.

School Mines Quart., 22, 71.

Determination by the Volhard method (1879: 14). Also precipitation by means of chlorate, separation from iron by means of acetates, and precipitation as phosphate.



- 1900: 9. McKENNA, A. G. The Analysis of Chrome and Tungsten Steels.

Eng. Min. J., 70, 124; Chem. Ztg., 24, 243, Rep; Analyst, 25, 301.

Precipitation by means of potassium chlorate, solution of the precipitate in hydrochloric acid and potassium nitrite, separation from iron by means of acetates, re-precipitation by means of bromine, and ignition to mangano-manganic oxide.

- 1900: 10. MIGNOT, A. Dosage volumétrique du manganèse dans les fers, fontes et aciers.

Ann. chim. anal. appl., 5, 172; Chem. Centrbl., 1900, b, 65; J. Soc. Chem. Ind., 19, 854; J. Chem. Soc. (Lond.), 78, 690; School Mines Quart., 22, 94.

Determination by oxidation to permanganic acid by means of bismuth tetroxide and titration with hydrogen peroxide.

- 1900: 11. PATTINSON, J., and H. S. Note on the Determination of Manganese as Sulphide.

Chem. News. 81, 193; J. Chem. Soc. (Lond.), 78, 443; Chem. Centrbl., 1900, a, 1244.

Discussion of the incomplete precipitation as sulphide.

- 1900: 12. TRUCHOT, P. Analyse des cuivres et des mattes industrielles.

Ann. chim. anal. appl., 5, 442.

Separation from cobalt and nickel, and determination by precipitation as manganese ammonium phosphate. Determination in commercial copper.

# SUBJECT INDEX.

## QUANTITATIVE DETERMINATION OF MANGANESE.

### (A) BY GRAVIMETRIC METHODS.

#### I. By precipitation as

##### (a) carbonate.

1819: 1 Brandes  
 1830: 2 Fuss  
 1836: 2 Thomson  
 1851: 1 Laming  
 1853: 8 Morfit and Booth  
 1867: 2 Forbes  
 1867: 4 Tosh  
 1869: 8 Prior  
 1870: 8 Rowan  
 1871: 5 Rowan  
 1872: 3 Fresenius  
 1872: 10 Tamm  
 1886: 16 Müller  
 1888: 10 Meineke  
 1893: 9 Jean  
 1897: 8a Hillebrand  
 1898: 1 Austin  
 1898: 3 Brearley  
 1900: 3 Hillebrand

##### (b) di-oxide, hydrated, by means of

##### (1) bromine.

1862: 1 Abel  
 1871: 3 Kammerer  
 1874: 3 Piesse  
 1874: 6 Willis  
 1877: 18 Riley  
 1879: 8 Mackintosh  
 1879: 14 Volhard  
 1880: 4 Dunston  
 1880: 9 de Koninck  
 1881: 11 Kent  
 1881: 17 Troilius  
 1882: 2 Cabot

1882: 4 Dewey  
 1882: 16 Troilius  
 1883: 22 Wolff  
 1884: 9 Holthof  
 1885: 17 Reinhardt  
 1885: 18 Reinhardt  
 1886: 1 Atkinson  
 1886: 16 Müller  
 1886: 22 Reinhardt  
 1886: 26 Sprenger  
 1886: 27 Wolff  
 1887: 18 ———  
 1888: 12 Oettel  
 1888: 14 v. Reis  
 1888: 21 ———  
 1889: 1 Alt  
 1890: 5 Fresenius and Hintz  
 1893: 11 Kosmann  
 1893: 13 Parry and Morgan  
 1894: 13 Saniter  
 1896: 11 Mignot  
 1900: 6 Ibbotson and Brearley

1900: 9 McKenna

##### (2) chlorine.

1865: 6 Warington  
 1878: 6 Müller

##### (3) electrolysis.

1865: 4 Luckow  
 1875: 1 Boussingault  
 1877: 17 Riche  
 1878: 8 Riche  
 1880: 10 Luckow  
 1881: 2 Classen  
 1881: 3 Classen and v. Reis

(3) electrolysis—*Continued.*

1882: 10 Keiser  
 1883: 18 Schucht  
 1884: 4 Classen  
 1884: 17 Wieland  
 1885: 4 Classen  
 1886: 18 Moore  
 1889: 3 Brand  
 1889: 7 Kohn and Woodgate  
 1889: 18 Smith and Fränkel  
 1891: 13 Luckow  
 1892: 18 Rüdorff  
 1892: 21 Warwick  
 1893: 14 Rüdorff  
 1894: 2 Classen  
 1894: 16 Thomälen  
 1895: 5 Engels  
 1895: 6 Engels  
 1895: 16 Neumann  
 1896: 6 Engels  
 1897: 7 Engels  
 1898: 13 Kaepfel  
 1898: 21 Wolman  
 1900: 4 Hiorns

## (4) hydrogen peroxide.

1877: 19 Rosenthal  
 1884: 7 Hanowsky  
 1886: 16 Müller  
 1887: 7 Donath and Zeller  
 1888: 11 Moore  
 1889: 15 Radau  
 1890: 4 Carnot  
 1893: 2 Carnot  
 1894: 4 Jones  
 1899: 7 Friedheim and Brühl

## (5) hypochlorites.

1866: 4 Reichardt  
 1875: 1 Boussingault  
 1877: 11 Kern

## (6) lead peroxide in neutral solution.

1852: 2 Gibbs  
 1853: 9 Parkinson  
 1860: 7 Rose  
 1879: 14 Volhard

## (7) potassium chlorate.

1877: 10 Hannay  
 1879: 1 Beilstein and Jawein  
 1881: 1 Beilstein and Jawein

1881: 8 Ford  
 1882: 16 Troilius  
 1884: 9 Holthof  
 1887: 18 —————  
 1893: 9 Jean  
 1895: 7 Forestier  
 1896: 11 Mignot  
 1896: 17 Viard  
 1900: 8 Jouët  
 1900: 9 McKenna

## (c) manganese ammonium phosphate.

1867: 3 Gibbs  
 1870: 11 Talbott  
 1871: 6 Tamm  
 1872: 1 Allen  
 1872: 3 Fresenius  
 1873: 2 Gibbs  
 1877: 1 Bolton  
 1877: 14 Munroe  
 1881: 8 Ford  
 1884: 3 Bloxam  
 1887: 2 Bayley  
 1887: 3 Blair  
 1888: 10 Meineke  
 1890: 3 Boyd  
 1890: 12 McKenna  
 1893: 9 Jean  
 1894: 13 Saniter  
 1896: 5 Dudley  
 1896: 11 Mignot  
 1898: 8 Gooch and Austin  
 1899: 5 Dunnington  
 1900: 1 Böttger  
 1900: 2 Dakin  
 1900: 8 Jouët  
 1900: 12 Truchot

## (d) manganous hydroxide.

1856: 1 Gurlt  
 1875: 2 Kern  
 1876: 4 Kern

## (e) oxalate.

1870: 2 Gibbs  
 1870: 3 Leison  
 1872: 3 Fresenius  
 1877: 3 Classen  
 1877: 7 Classen

## (f) sulphide.

1821: 2 Pfaff

**(f) sulphide—Continued.**

1857: 4 Terreil  
 1860: 2 Gorgeu  
 1860: 5 Rose  
 1860: 6 Rose  
 1861: 1 Fresenius  
 1863: 3 Lippert  
 1867: 2 Forbes  
 1867: 4 Tosh  
 1869: 1 Classen  
 1869: 4 How  
 1870: 11 Talbott  
 1872: 3 Fresenius  
 1876: 2 Fresenius  
 1876: 4 Kern  
 1877: 5 Classen  
 1879: 1 Beilstein and Jawein  
 1879: 2 Carnot  
 1879: 7 Ledebur  
 1880: 2 Delffs  
 1883: 23 Zulkowsky  
 1885: 11 v. Jüptner  
 1888: 3 Friedmann  
 1888: 10 Meineke  
 1888: 16 Schürmann  
 1890: 5 Fresenius and Hintz  
 1893: 9 Jean  
 1894: 13 Saniter  
 1897: 8 Granger  
 1898: 15 Murmann  
 1898: 16 Murmann  
 1900: 11 Pattinson

**(g) vanadate.**

1887: 6 Carnot

**II. By ignition to****(a) mangano-manganic oxide.**

1836: 2 Thomson  
 1856: 1 Gurlt  
 1860: 2 Gorgeu  
 1865: 6 Warington  
 1866: 4 Reichardt  
 1867: 2 Forbes  
 1867: 4 Tosh  
 1870: 8 Rowan  
 1872: 3 Fresenius  
 1874: 3 Piesse  
 1874: 6 Willis  
 1875: 2 Kern  
 1876: 4 Kern

1877: 3 Classen  
 1877: 12 Kern  
 1878: 6 Müller  
 1879: 14 Volhard  
 1880: 4 Dunston  
 1881: 17 Troilius  
 1882: 2 Cabot  
 1882: 16 Troilius  
 1883: 22 Wolff  
 1884: 7 Hanowsky  
 1885: 11 v. Jüptner  
 1886: 16 Müller  
 1887: 7 Donath and Zeller  
 1887: 18 ———  
 1888: 12 Oettel  
 1888: 14 v. Reis  
 1888: 21 ———  
 1889: 3 Brand  
 1889: 7 Kohn and Woodgate  
 1891: 21 Pattinson  
 1893: 9 Jean  
 1893: 13 Parry and Morgan  
 1894: 2 Classen  
 1894: 13 Saniter  
 1895: 7 Forestier  
 1896: 14 Rürup  
 1897: 8a Hillebrand  
 1898: 1 Austin  
 1898: 7 Gooch and Austin  
 1900: 4 Hiorns  
 1900: 9 McKenna

**(b) manganous oxide.**

1843: 2 Ebelmen  
 1875: 2 Kern

**(c) pyrophosphate. See "precipitation as manganese-ammonium phosphate."****(d) sulphate.**

1879: 14 Volhard  
 1885: 15 Meineke  
 1888: 21 ———  
 1898: 1 Austin  
 1898: 7 Gooch and Austin

**(e) sulphide.**

1860: 5 Rose  
 1860: 6 Rose  
 1863: 3 Lippert  
 1876: 2 Fresenius  
 1879: 2 Carnot

**III. By the method of****(a) Classen (oxalate).**

1877: 3 Classen

1877: 7 Classen

1894: 9 Nass

**(b) Ford.**

1881: 5 Deshayes

1881: 8 Ford

1896: 5 Dudley

1896: 14 Rürup

**(c) Gibbs (pyrophosphate).**

1867: 3 Gibbs

1871: 6 Tamm

1872: 1 Allen

1877: 1 Bolton

1890: 12 McKenna

**(d) Rüdorff.**

1892: 18 Rüdorff

1895: 8 Gröger

**(e) Wolff.**

1883: 22 Wolff

1885: 14 Mathesius

1885: 17 Reinhardt

1885: 18 Reinhardt

1886: 27 Wolff

1891: 5 Chemiker - Commission

1893: 11 Kosman

**IV. By miscellaneous methods.****(a) by difference.**

1877: 18 Riley

1879: 7 Ledebur

1884: 2 Atkinson

1884: 8 Holdich

1885: 7 Diehl

1888: 21 ———

**(b) by dry assay.**

1872: 11 Tamm

1896: 3 Büttgenbach

**(c) from oxygen absorbed by alkaline solutions.**

1864: 4 Mittenzwey

**(B) BY VOLUMETRIC METHODS.****I. By titration with potassium permanganate solution.****(a) Direct titration.**

1863: 2 Guyard

1864: 6 Winkler

1865: 3 Habich

1872: 3 Fresenius

1878: 4 Morawski and Stingl

1879: 14 Volhard

1880: 5 Haswell

1880: 7 v. Jüptner

1881: 6 Donath

1881: 7 Emmerton

1881: 15 Särnström

1883: 6 v. Jüptner

1883: 11 Meineke

1883: 14 Särnström

1883: 15 Särnström

1883: 17 Schöffel and Donath

1883: 23 Zulskowsky

1884: 1 Anger

1884: 6 Gmelin

1884: 15 Meineke

1884: 18 Wolff

1885: 18 Reinhardt

1885: 20 Wolff

1886: 23 Reinhardt

1886: 27 Wolff

1886: 28 Zimmermann

1887: 4 Brand

1887: 9 Jolles

1888: 4 Ghilian

1891: 2 Blum

1891: 4 Brown

1891: 5 Chemiker - Commission

1891: 9 Hampe

1891: 16 Moldenhauer

1891: 25 Rubricius

1891: 26 Rürup

1892: 1 Aller

1892: 4 Campredon

1892: 7 Donath

1892: 12 v. Reis

1892: 16 Rubricius

1892: 17 Rubricius

1893: 1 Carnot

1893: 6 Gorgeu

1893: 9 Jean

1894: 13 Saniter

1894: 14 Seeliger

1895: 2 Auchy

1895: 18 Thomas

**(a) Direct titration—Continued.**

- 1896: 1 Auchy
- 1896: 12 Mixer and Dubois
- 1896: 13 Murkewitsch
- 1896: 14 Rürup
- 1896: 15 Stone
- 1897: 1 Auchy
- 1897: 3 Brearley
- 1897: 6 Devisse
- 1897: 10 Longi and Camilla
- 1898: 4 Campredon
- 1898: 14 Lehnkering
- 1899: 1 Brearley
- 1899: 4 Daw
- 1899: 8 Herting
- 1899: 10 Namias
- 1900: ■ Joutet

**(b) Indirect titration.**

- 1883: 10 Meineke
- 1883: 11 Meineke
- 1885: 15 Meineke
- 1886: 15 Meineke
- 1886: 17 Müller
- 1886: 24 Schöffel and Donath
- 1887: 13 Lax
- 1891: 5 Chemiker - Commission
- 1891: 9 Hampe
- 1896: 7 Giorgis
- 1899: 13 Reichard

**II. By precipitation as di-oxide, solution with the aid of a reducing agent, and titration for the excess of the latter.****Precipitation by means of****(a) bromine.**

- 1872: 5 Kessler
- 1872: 6 Kessler
- 1879: 6 Kessler
- 1879: 7 Ledebur
- 1887: 14 Meineke
- 1887: 17 Reinhardt
- 1888: 13 Reinhardt
- 1893: 12 Low

**(b) chlorine.**

- 1861: 4 Möller

**(c) hydrogen peroxide.**

- 1886: 2 Barlow
- 1888: 2 Carnot

- 1889: 12 McCulloch
- 1890: 2 van Bemmeln
- 1893: 2 Carnot
- 1894: 4 Jones
- 1895: 4 Carnot
- 1895: 7 Forestier
- 1895: 19 Ulzer and Brüll

**(d) hypochlorite.**

- 1853: 4 Hempel
- 1854: 2 Streng
- 1855: 1 Mohr
- 1855: 2 Müller
- 1879: 9 Pattinson
- 1879: 10 Pattinson
- 1880: 13 Pattinson
- 1880: 16 Weldon
- 1880: 18 Wright and Menke
- 1884: 11 Ledebur
- 1886: 1 Atkinson
- 1887: 13 Lax
- 1893: 9 Jean

**(e) potassium chlorate.**

- 1877: 10 Hannay
- 1881: 18 Williams
- 1883: 4 Hampe
- 1883: 9 Mackintosh
- 1883: 13 Raimond
- 1883: 19 Stone
- 1883: 20 Stone
- 1883: 21 Troilius
- 1884: 11 Ledebur
- 1884: 12 Mackintosh
- 1885: 3 Cheever
- 1885: 10 Hampe
- 1885: 15 Meineke
- 1887: 13 Lax
- 1887: 15 Meineke
- 1888: 7 Julian
- 1888: 13 Reinhardt
- 1891: 4 Brown
- 1891: 5 Chemiker - Commission
- 1891: 9 Hampe
- 1891: 19 Norris
- 1891: 23 v. Reis
- 1891: 28 Ukena
- 1892: 2 Bastin
- 1892: 5 Chemiker - Commission

**(e) potassium chlorate—Continued.**

1892: 9 Hampe  
 1892: 13 v. Reis  
 1893: 9 Jean  
 1893: 10 Julian  
 1893: 13 Parry and Morgan  
 1894: 5 Jones  
 1895: 2 Auchy  
 1895: 7 Forestier  
 1895: 19 Ulzer and Brüll  
 1896: 5 Dudley  
 1896: 14 Rürup  
 1897: 9 Julian  
 1898: 6 Ford and Bregowsky  
 1898: 14 Lehnkering  
 1899: 16 J. T.  
 1900: 6 Ibbotson and Brearley

**(f) reduction of manganate by alcohol.**

1890: 13 Myhlertz

**(g) sodium chlorate.**

1898: 9 Gooch and Austin  
 1899: 8 Herting

**Solution of the peroxide with the aid of****(a) antimonious chloride.**

1872: 5 Kessler  
 1872: 6 Kessler  
 1879: 6 Kessler  
 1879: 7 Ledebur

**(b) arsenious oxide.**

1898: 9 Gooch and Austin

**(c) ferrous salts or oxalic acid.**

1853: 4 Hempel  
 1877: 10 Hannay  
 1879: 9 Pattinson  
 1879: 10 Pattinson  
 1880: 13 Pattinson  
 1880: 16 Weldon  
 1880: 18 Wright and Menke  
 1881: 18 Williams  
 1883: 4 Hampe  
 1883: 9 Mackintosh  
 1883: 13 Raimond  
 1883: 19 Stone  
 1883: 20 Stone  
 1883: 21 Troilius  
 1884: 11 Ledebur

1884: 12 Mackintosh  
 1885: 3 Cheever  
 1885: 10 Hampe  
 1885: 15 Meineke  
 1886: 1 Atkinson  
 1887: 13 Lax  
 1887: 14 Meineke  
 1887: 15 Meineke  
 1887: 17 Reinhardt  
 1888: 2 Carnot  
 1888: 7 Julian  
 1888: 13 Reinhardt  
 1889: 12 McCulloch  
 1890: 2 van Bemmeln  
 1890: 13 Myhlertz  
 1891: 4 Brown  
 1891: 5 Chemiker - Commission  
 1891: 9 Hampe  
 1891: 19 Norris  
 1891: 23 v. Reis  
 1891: 28 Ukena  
 1892: 2 Bastin  
 1892: 5 Chemiker - Commission  
 1892: 9 Hampe  
 1892: 13 v. Reis  
 1893: 2 Carnot  
 1893: 9 Jean  
 1893: 12 Low  
 1893: 13 Parry and Morgan  
 1894: 4 Jones, H. C.  
 1894: 5 Jones, J.  
 1895: 2 Auchy  
 1895: 4 Carnot  
 1895: 7 Forestier  
 1895: 18 Thomas  
 1895: 19 Ulzer and Brüll  
 1896: 5 Dudley  
 1896: 14 Rürup  
 1898: 6 Ford and Bregowsky  
 1898: 14 Lehnkering  
 1899: 16 J. T.  
**(d) hydrochloric acid (Bunsen).**  
 1861: 4 Möller  
 1886: 2 Barlow  
**(e) hydrogen peroxide.**  
 1893: 10 Julian



**(e) hydrogen peroxide—Continued.**

1897: 9 Julian

**(f) potassium iodide.**

1898: 9 Gooch and Austin

**(g) stannous chloride.**

1854: 2 Streng

1855: 1 Mohr

1855: 2 Müller

**III. By titration of permanganic acid,  
after oxidation by means of****(a) bismuth tetroxide.**

1888: 15 Schneider

1889: 17 Schneider

1898: 4 Campredon

1900: 10 Mignot

**(b) lead peroxide.**

1871: 2 Chatard

1872: 7 Leclerc

1877: 8 Deby

1878: 2 Deshayes

1878: 7 Prochaska

1881: 9 Forguignon

1885: 19 Schlagdenhauffen

1886: 21 Perillou

1886: 25 Setterwall

1887: 1 Babbitt

1887: 5 Cheever

1887: 19 ———

1888: 17 Stein

1888: 18 Thorpe and Hambly

1888: 19 Thorpe and Hambly

1892: 19 Schneider

1892: 20 Van Grundy

1900: 5 Ibbotson and Brearley

1900: 7 Jervis

**(c) sodium bismuthate.**

1895: 17 Reddrop and Ramage

**Titration of the permanganic acid  
by means of****(a) ammonium oxalate.**

1871: 2 Chatard

1888: 18 Thorpe and Hambly

1888: 19 Thorpe and Hambly

**(b) arsenious oxide.**

1877: 8 Deby

1878: 2 Deshayes

1886: 25 Setterwall

1887: 19 ———

1892: 20 Van Grundy

**(c) ferrous salts.**

1878: 7 Prochaska

1886: 21 Perillou

1888: 17 Stein

1900: 7 Jervis

**(d) hydrogen peroxide.**

1888: 15 Schneider

1889: 17 Schneider

1892: 19 Schneider

1895: 17 Reddrop and Ramage

1898: 4 Campredon

1900: 10 Mignot

**(e) mercurous nitrate.**

1872: 7 Leclerc

1881: 9 Forguignon

1885: 19 Schlagdenhauffen

**IV. By the method of****(a) Chatard.**

1871: 2 Chatard

1888: 18 Thorpe and Hambly

1888: 19 Thorpe and Hambly

1888: 20 Weissmann

**(b) Carnot.**

1888: 2 Carnot

1889: 12 McCulloch

1890: 2 van Bemmeln

1890: 4 Carnot

1897: 2 van Bemmeln

**(c) Deshayes.**

1878: 2 Deshayes

1887: 19 ———

**(d) Donath.**

1881: 6 Donath

1893: 6 Gorgeu

**(e) Guyard.**

1863: 2 Guyard

1865: 3 Habich

1882: 6 Dunn

1884: 15 Meineke

1893: 1 Carnot

1893: 6 Gorgeu

1893: 9 Jean

**(f) Hampe.**

1883: 4 Hampe

1884: 11 Ledebur

1885: 10 Hampe

**(f) Hampe—Continued.**

- 1886: 23 Reinhardt  
 1886: 24 Schöffel and Donath  
 1887: 13 Lax  
 1887: 15 Meineke  
 1888: 13 Reinhardt  
 1891: 5 Chemiker - Commission  
 1891: 23 v. Reis  
 1892: 5 Chemiker - Commission  
 1892: 9 Hampe  
 1892: 13 v. Reis  
 1894: 5 Jones, J.  
 1895: 19 Ulzer and Brüll  
 1896: 14 Rürup

**(g) Kessler.**

- 1872: 5 Kessler  
 1872: 6 Kessler  
 1879: 6 Kessler  
 1887: 13 Lax

**(h) Leclerc.**

- 1872: 7 Leclerc  
 1881: 9 Forguignon  
 1885: 19 Schlagdenhauffen

**(i) Lenssen.**

- 1860: 3 Lenssen.  
 1864: 2 Fresenius

**(j) Meineke.**

- 1883: 10 Meineke  
 1883: 11 Meineke  
 1885: 15 Meineke  
 1886: 15 Meineke  
 1886: 17 Müller  
 1886: 23 Reinhardt  
 1887: 13 Lax  
 1891: 5 Chemiker - Commission

**(k) Morawski and Stingl.**

- 1878: 4 Morawski and Stingl  
 1884: 15 Meineke

**(l) Pattinson.**

- 1879: 9 Pattinson  
 1880: 18 Wright and Menke  
 1884: 11 Ledebur  
 1886: 1 Atkinson  
 1886: 20 Pattinson  
 1887: 13 Lax  
 1891: 21 Pattinson

1893: 9 Jean

1894: 13 Saniter

**(m) Reinhardt.**

- 1888: 13 Reinhardt  
 1891: 5 Chemiker - Commission

**(n) Rössler.**

- 1879: 13 Rössler  
 1880: 15 Rössler  
 1894: 14 Seeliger

**(o) Rürup.**

- 1891: 2 Blum  
 1891: 25 Rubricius  
 1891: 26 Rürup

**(p) Särnström.**

- 1881: 15 Särnström  
 1883: 7 Kerl  
 1883: 15 Särnström  
 1890: 6 Hellman  
 1896: 12 Mixer and Dubois  
 1897: 1 Auchy

**(q) Schneider.**

- 1889: 17 Schneider  
 1895: 17 Reddrop and Ramage  
 1898: 4 Campredon

**(r) Schöffel and Donath.**

- 1883: 14 Särnström  
 1883: 17 Schöffel and Donath  
 1886: 24 Schöffel and Donath  
 1887: 13 Lax  
 1891: 5 Chemiker - Commission

**(s) Volhard.**

- 1879: 14 Volhard  
 1880: 5 Haswell  
 1880: 7 v. Jüptner  
 1881: 7 Emmerton  
 1882: 8 Haswell  
 1883: 6 v. Jüptner  
 1883: 11 Meineke  
 1884: 6 Gmelin  
 1884: 11 Ledebur  
 1884: 15 Meineke  
 1887: 9 Jolles  
 1888: 6 Iles  
 1891: 2 Blum  
 1891: 4 Brown  
 1891: 16 Moldenhauer

- (s) **Volhard**—*Continued*  
 1891: 20 Namias  
 1891: 25 Rubricius  
 1891: 26 Rürup  
 1892: 1 Aller  
 1892: 12 v. Reis  
 1892: 16 Rubricius  
 1892: 17 Rubricius  
 1894: 13 Saniter  
 1895: 2 Auchy  
 1895: 18 Thomas  
 1896: 1 Auchy  
 1896: 13 Murkewitsch  
 1896: 14 Rürup  
 1896: 15 Stone  
 1897: 6 Devisse  
 1897: 10 Longi and Camilla  
 1898: 4 Campredon  
 1898: 14 Lehnkering  
 1899: 1 Brearley  
 1899: 4 Daw  
 1899: 8 Herting  
 1899: 10 Namias  
 1900: 8 Jouet
- (t) **Weissmann**.  
 1888: 17 Stein  
 1888: 20 Weissmann  
 1895: 19 Ulzer and Brüll
- (u) **Williams**.  
 1881: 18 Williams  
 1883: 9 Mackintosh  
 1883: 21 Troilius  
 1884: 12 Mackintosh  
 1885: 3 Cheever  
 1891: 4 Brown  
 1892: 2 Bastin  
 1893: 13 Parry and Morgan  
 1895: 2 Auchy  
 1896: 5 Dudley  
 1898: 6 Ford and Bregowsky  
 1899: 16 J. T.  
 1900: 6 Ibbotson and Brearley
- V. By miscellaneous methods.**  
 (a) **by means of alkali sulphides.**  
 1894: 10 Neumann  
 (b) **by reduction of potassium ferri-cyanide.**  
 1860: 3 Lenssen  
 1864: 2 Fresenius  
 (c) **by means of potassium ferro-cyanide.**  
 1889: 13 Moldenhauer  
 1891: 3 Blum  
 1891: 14 Luckow  
 1891: 17 Moldenhauer  
 1897: 12 Miller  
 1897: 13 Miller and Mathews  
 1897: 16 Stone and van Ingen  
 (d) **by means of tartaric or malic acids.**  
 1868: 2 Juette  
 (e) **by means of silver nitrate (indirect).**  
 1879: 13 Rössler  
 1880: 15 Rössler  
 1894: 14 Seeliger  
 (f) **by the titration of manganate.**  
 1881: 10 Iles  
 1885: 12 Kalmann and Smolka  
 1899: 14 Reichard  
 (g) **by the titration of manganic phosphate.**  
 1883: 4 Hampe.  
 1891: 18 Moore  
 (h) **by means of iodine (indirect).**  
 1890: 16 Vortmann  
 (i) **by solution of ignited oxide in reducing agents.**  
 1876: 3 Galbraith  
 1886: 2 Barlow
- (C) BY COLORIMETRIC METHODS.**  
**I. By oxidation to permanganic acid by means of**  
 (a) **bismuth tetroxide.**  
 1895: 7 Forestier  
 1896: 11 Mignot  
 (b) **lead peroxide.**  
 1872: 8 Pichard  
 1876: 5 Peters  
 1881: 5 Deshayes  
 1883: 1 Goetz  
 1882: 11 Ledebur  
 1886: 8 Cheever  
 1886: 13 Hunt

**(b) lead peroxide—Continued.**

- 1887: 5 Cheever  
 1887: 16 Morgan  
 1893: 13 Parry and Morgan  
 1895: 7 Forestier  
 1896: 1 Auchy  
 1896: 11 Mignot  
 1897: 11 Lemaire  
 1897: 15 Schneider  
 1898: 18 Pichard

**II. By the formation of metaphosphate.**

- 1885: 16 Osmond  
 1891: 24 Rossi

**III. By the formation of manganate.**

- 1873: 1 Brünner  
 1874: 1 Koppmayer

**IV. By the liberation of iodine.**

- 1874: 2 Morrell  
 1875: 4 Morrell

**(D) GENERAL DISCUSSION OF METHODS.**

- 1875: 12 Bolton  
 1881: 11 Kent  
 1882: 6 Dunn  
 1882: 15 Tamm  
 1883: 16 Schmitt  
 1884: 13 Mackintosh  
 1884: 16 Stone  
 1885: 19 Schlagdenhauffen  
 1887: 13 Lax  
 1888: 10 Meineke  
 1889: 4 Finkener  
 1891: 21 Pattinson  
 1894: 13 Saniter  
 1895: 15 v. Juptner  
 1895: 16 Neumann  
 1896: 1 Auchy  
 1896: 4 Dewey  
 1896: 10 v. Juptner  
 1896: 14 Rürup  
 1897: 15 Schneider  
 1898: 13 Kaepfel (electro-lytic)  
 1898: 21 Wolman (electro-lytic)  
 1899: 3 Brearley

**(E) SEPARATION FROM OTHER ELEMENTS.****(a) from alkaline earths.**

- 1852: 2 Gibbs  
 1853: 9 Parkinson  
 1861: 4 Möller  
 1886: 2 Barlow

**(b) from aluminum.**

- 1860: 6 Rose  
 1865: 2 Gibbs  
 1865: 5 Rube  
 1879: 4 Classen  
 1879: 14 Volhard  
 1881: 3 Classen  
 1899: 9 Hess and Campbell

**(c) from arsenic.**

- 1837: 4 Sheerer  
 1895: 13 Jannasch and Kammerer

**(d) from cadmium.**

- 1889: 3 Brand  
 1891: 27 Smith  
 1892: 21 Warwick  
 1895: 14 Jannasch and Röttgen

**(e) from calcium.**

- 1827: 3 Stromeyer  
 1860: 6 Rose  
 1877: 4 Classen  
 1889: 2 Blum  
 1889: 16 Reitmar  
 1892: 14 Riggs

**(f) from cerium.**

- 1864: 3 Gibbs

**(g) from chromium.**

- 1865: 2 Gibbs  
 1884: 5 Classen  
 1894: 6 Kassner  
 1894: 11 Poleck  
 1895: 10 Jannasch and Cloedt  
 1898: 3 Brearley  
 1899: 7 Friedheim and Brühl

**(h) from cobalt by means of****(1) chlorine.**

- 1866: 5 Terreil

**(2) citrates.**

- 1892: 10 Moore

- (3) cyanides.  
 1841: 3 Liebig  
 1853: 2 Flajolot  
 1887: 10 Klobb  
 1889: 11 McCulloch
- (4) electrolysis.  
 1888: 12 Oettel  
 1889: 3 Brand  
 1891: 15 Le Roy  
 1898: 5 Engels
- (5) hydrogen peroxide.  
 1886: 2 Barlow  
 1887: 7 Donath and Zeller  
 1891: 10 Jannasch and Franzek  
 1896: 9 Jannasch and Lehner
- (6) hypochlorite, hydrofluoric acid and ammonia.  
 1841: 4 Ullgren
- (7) magnesium.  
 1832: 2 Döbereiner
- (8) Mercuric oxide.  
 1835: 2 Persoz
- (9) nitroso- $\beta$ -naphthol.  
 1896: 2 Burgass
- (10) oxalates.  
 1827: 1 Du Menil
- (11) phosphates.  
 1858: 2 Henry  
 1900: 12 Truchot
- (12) potassium permanganate.  
 1866: 5 Terreil
- (13) potassium polysulphide.  
 1845: 1 Cloez
- (14) silver nitrate and ammonia.  
 1839: 3 W.
- (15) sodium peroxide.  
 1893: 5 Clark
- (16) solubility of chlorides in ether.  
 1837: 1 Döbereiner
- (17) the solubilities of the sulphides.  
 1838: 2 Wackenroder  
 1846: 1 Barreswil  
 1847: 3 Rose  
 1847: 4 Strecker  
 1849: 1 Ebelmen
- 1865: 2 Gibbs  
 1866: 3 Frohde  
 1869: 7 Muck  
 1881: 4 Delvaux  
 1886: 26 Sprenger  
 1890: 5 Fresenius and Hintz  
 1897: 8a Hillebrand  
 1900: 3 Hillebrand
- (18) volatility of chloride.  
 1846: 4 Völker
- (i) from copper.  
 1869: 5 Luckow  
 1884: 5 Classen  
 1887: 11 v. Knorre  
 1887: 12 v. Knorre  
 1889: 3 Brand  
 1893: 14 Rüdorff  
 1895: 14 Jannasch and Röttgen  
 1896: 2 Burgass  
 1896: 8 Jannasch  
 1897: 8a Hillebrand  
 1899: 6 Fernberger and Smith  
 1899: 7 Friedheim and Brähl
- (j) from gallium.  
 1882: 1 de Boisbaudran
- (k) from iron by means of
- (1) acetates.  
 1841: 2 Henry  
 1862: 1 Abel  
 1865: 2 Gibbs  
 1866: 2 Eggertz  
 1866: 4 Reichardt  
 1867: 4 Tosh  
 1869: 2 Damour  
 1870: 8 Rowan  
 1872: 5 Kessler  
 1872: 6 Kessler  
 1874: 3 Piesse  
 1874: 6 Willis  
 1875: 1 Boussingault  
 1875: 4 Morrell  
 1877: 13 Krämer  
 1877: 18 Riley  
 1877: 19 Rosenthal  
 1877: 20 Stöckman  
 1878: 3 Matzurka  
 1878: 6 Müller  
 1879: 8 Mackintosh

(1) acetates—*Continued.*

- 1880: 4 Dunston  
 1880: 6 Jewett  
 1881: 11 Kent  
 1881: 17 Troilius  
 1882: 2 Cabot  
 1882: 4 Dewey  
 1882: 9 Jewett  
 1884: 3 Bloxam  
 1886: 1 Atkinson  
 1886: 12 Deane  
 1886: 16 Müller  
 1886: 22 Reinhardt  
 1886: 26 Sprenger  
 1887: 18 ———  
 1888: 4 Ghilian  
 1888: 10 Meineke  
 1888: 14 v. Reis  
 1888: 21 ———  
 1889: 9 Mayer (qualitative)  
 1892: 4 Campredon  
 1892: 11 Priwoznik  
 1892: 14 Riggs  
 1893: 9 Jean  
 1893: 11 Kosman  
 1893: 13 Parry and Morgan  
 1895: 7 Forestier  
 1897: 3 Brearley  
 1897: 4 Brearley  
 1899: 2 Brearley  
 1900: 8 Jouët  
 1900: 9 McKenna

## (2) ammonia in the presence of ammonium chloride.

- 1813: 1 Hatchett  
 1830: 2 Fuss  
 1876: 4 Kern

## (3) arsenates.

- 1827: 1 Du Menil  
 1827: 2 Quesneville  
 1829: 3 Martini

## (4) benzoic acid.

- 1806: 1 Berzelius  
 1812: 1 Pfaff  
 1829: 3 Martini  
 1836: 2 Thomson  
 1877: 9 Funaro

## (5) camphoric acid.

- 1832: 5 Kastner

## (6) chlorate.

See "precipitation by means of chlorate." See pp. 98 and 101

## (7) chlorides.

- 1797: 1 Kirwan  
 1837: 4 Scheerer  
 1863: 3 Lippert

## (8) chlorine.

- 1853: 12 Schiel  
 1861: 4 Möller

## (9) electrolysis.

- 1830: 1 Becquerel  
 1881: 2 Classen  
 1881: 3 Classen and v. Reis  
 1882: 10 Keiser  
 1885: 5 Classen  
 1886: 10 Classen  
 1886: 11 Classen  
 1888: 12 Oettel  
 1889: 7 Kohn and Woodgate  
 1891: 15 Le Roy  
 1896: 6 Engels  
 1898: 5 Engel

## (10) ether.

- 1892: 15 Rothe

## (11) fusion with alkali and nitrate.

- 1833: 2 Planiawa  
 1894: 14 Seeliger

## (12) ferrocyanide.

- 1886: 5 Blum

## (13) hydrogen peroxide.

- 1888: 11 Moore

## (14) iodine.

- 1879: 1 Beilstein and Jawein  
 1881: 1 Beilstein and Jawein

## (15) a magnet after ignition in hydrogen.

- 1875: 2 Kern

## (16) neutralization with carbonates.

- 1799: 1 Vauquelin  
 1812: 1 Pfaff  
 1821: 1 Herschell  
 1831: 1 Fuchs  
 1831: 2 Liebig  
 1832: 2 Döbereiner  
 1832: 6 Liebig  
 1834: 1 Demarçay

(16) neutralization with carbonates—*Continued.*

- 1853: 8 Morfit and Booth  
 1856: 1 Gurlt  
 1867: 2 Forbes  
 1885: 11 v. Jüptner  
 1888: 1 Campbell  
 1888: 4 Ghilian  
 1888: 10 Meineke  
 1890: 5 Fresenius and Hintz

## (17) neutralization with metallic oxides.

- 1835: 2 Persoz  
 1857: 3 Field  
 1860: 1 Field  
 1865: 5 Rube  
 1872: 9 de Rezende  
 1879: 14 Volhard  
 1888: 10 Meineke  
 1894: 15 Smith and Heyl  
 See also (27).

(18) nitroso- $\beta$ -naphthol.

- 1887: 11 v. Knorre  
 1887: 12 v. Knorre  
 1888: 10 Meineke  
 1890: 8 de Koninck  
 1896: 2 Burgass

## (19) oxalates.

- 1806: 2 John  
 1811: 1 Bucholz  
 1827: 1 Du Menil  
 1829: 2 Lassaigne  
 1877: 6 Classen  
 1879: 4 Classen  
 1879: 5 Classen

## (20) potassium "anthrazothionate"

- 1817: 1 Grotthuss

## (21) suberic acid.

- 1832: 5 Kastner

## (22) succinic acid.

- 1806: 1 Berzelius  
 1806: 2 John  
 1812: 1 Pfaff  
 1827: 2 Quesneville  
 1829: 3 Martini  
 1872: 10 Tamm  
 1877: 9 Funaro  
 1886: 4 Bein

- 1888: 4 Ghilian

- 1896: 11 Mignot

## (23) sulphates.

- 1827: 2 Quesneville  
 1837: 4 Scheerer  
 1872: 5 Kessler  
 1872: 6 Kessler  
 1879: 6 Kessler  
 1888: 10 Meineke  
 1896: 14 Rürup

## (24) solubilities of the sulphides.

- 1838: 2 Wackenroder  
 1886: 6 Carnot

## (25) tartrates.

- 1792: 1 Hermbstädt  
 1796: 1 Richter  
 1812: 1 Pfaff

## (26) volatilization of ferric chloride.

- 1814: 1 Davy  
 1819: 1 Brandes  
 1877: 12 Kern  
 1880: 3 Drown and Shimer  
 1888: 3 Friedmann

## (27) zinc oxide.

- 1879: 14 Volhard  
 1880: 5 Haswell  
 1880: 7 v. Jüptner  
 1881: 7 Emmerton  
 1883: 10 Meineke  
 1884: 6 Gmelin  
 1884: 18 Wolff  
 1885: 14 Mathesius  
 1885: 20 Wolff  
 1887: 9 Jolles  
 1887: 14 Meineke  
 1887: 17 Reinhardt  
 1888: 10 Meineke  
 1895: 7 Forestier  
 1895: 19 Ulzer and Brüll

## (28) (method not indicated.)

- 1786: 1 Rinmann  
 1819: 2 Faraday  
 1819: 3 Pfaff

## (l) from lead.

- 1896: 13a Neumann

## (m) from magnesium.

- 1827: 3 Stromeyer  
 1860: 6 Rose



**(m) from magnesium—Continued.**

- 1868: 4 Terreil  
1869: 2 Damour

**(n) from mercury.**

- 1886: 11 Classen and Ludwig  
1889: 3 Brand  
1894: 12 Rüdorff  
1895: 9 Jannasch and Cloedt  
1898: 12 Jannasch and Alfiers

**(o) nickel, by means of****(1) ammonium carbonate.**

- 1872: 10 Tamm

**(2) atmospheric oxygen.**

- 1881: 4 Delvaux

**(3) chlorine.**

- 1853: 12 Schiel  
1866: 5 Terreil

**(4) electrolysis**

- 1886: 14 Langbein  
1886: 19 Moore  
1889: 3 Brand  
1891: 15 Le Roy  
1896: 6 Engels  
1898: 5 Engels

**(5) hypochlorites, hydrofluoric acid, and ammonia.**

- 1841: 4 Ullgren

**(6) mercuric oxide.**

- 1835: 2 Persoz

**(7) peroxides.**

- 1852: 2 Gibbs  
1853: 9 Parkinson  
1860: 7 Rose  
1886: 2 Barlow  
1887: 7 Donath and Zeller  
1891: 10 Jannasch and Franzek  
1893: 5 Clark  
1896: 9 Jannasch and Lehnert  
1899: 7 Friedheim and Brühl

**(8) phosphates.**

- 1858: 2 Henry  
1900: 12 Truchot

**(9) potassium permanganate.**

- 1866: 5 Terreil

**(10) through the solubilities of the sulphides.**

- 1838: 2 Wackenroder  
1847: 3 Rose

- 1849: 1 Ebelmen

- 1863: 3 Lippert

- 1865: 2 Gibbs

- 1866: 3 Frohde

- 1886: 6 Carnot

- 1886: 26 Sprenger

- 1888: 11 Moore

- 1890: 5 Fresenius and Hintz

- 1894: 3 Fleitmann

- 1897: 8a Hillebrand

- 1900: 3 Hillebrand

**(11) (method not indicated.)**

- 1882: 14 Mills and Becket

**(p) from phosphoric acid.**

- 1881: 2 Classen

**(q) from silica.**

- 1886: 12 Deane

- 1898: 6 Ford and Bregowsky

**(r) from silver.**

- 1895: 12 Jannasch and Kammerer

**(s) from thallium.**

- 1864: 1 Crookes

**(t) from tin.**

- 1853: 7 Löwenthal.  
1861: 6 Rose

**(u) from tungstic acid.**

- 1896: 16 Taggart and Smith

**(v) from vanadium.**

- 1889: 15 Radau

**(w) from zinc by means of****(1) carbonate.**

- 1872: 10 Tamm  
1879: 3 Classen

**(2) acetic acid.**

- 1788: 1 Porcel  
1837: 3 Richter  
1886: 4 Bein

**(3) ammonium sulphocarbonate**

- 1882: 7 Guyard

**(4) ammonium sulphocyanate.**

- 1880: 20 Zimmermann

**(5) bromine**

- 1869: 3 Galetti  
1892: 3 Blum

**(6) cyanides.**

- 1853: 2 Flajalot

**(7) electrolysis.**

- 1830: 1 Becquerel.

**(7) electrolysis—Continued.**

- 1889: 3 Brand  
 1891: 21 Warwick  
 1899: 15 Riederer

**(8) peroxides.**

- 1852: 2 Gibbs  
 1853: 9 Parkinson  
 1860: 7 Rose  
 1886: 2 Barlow  
 1887: 7 Donath and Zeller  
 1890: 7 Jensch  
 1891: 7 Donath  
 1891: 11 Jannasch and Mac-  
     Gregory  
 1891: 12 Jannasch and Nieder-  
     hofheim  
 1893: 5 Clark  
 1895: 11 Jannasch and Cloedt  
 1897: 8a Hillebrand  
 1899: 7 Friedheim and Brühl  
 1900: 3 Hillebrand

**(9) phosphates.**

- 1869: 9 Renard  
 1886: 14a Lösekann and Meyer

**(10) solubilities of the sulphides.**

- 1838: 2 Wackenroder  
 1842: 3 Otto  
 1849: 1 Ebelmen  
 1863: 3 Lippert  
 1865: 2 Gibbs  
 1868: 4 Terreil  
 1885: 9 Hampe  
 1887: 2 Bayley  
 1889: 14 Neumann  
 1890: 5 Fresenius and Hintz  
 1890: 14 Riban

**(F) APPLICATIONS OF QUANTI-  
TATIVE METHODS.****Determination in****(1) chromite.**

- 1890: 5 Fresenius and Hintz

**(2) chromium alloys.**

- 1877: 11 Kern  
 1892: 19 Schneider  
 1899: 16 J. T.  
 1900: 5 Ibbotson and Brear-  
     ley  
 1900: 9 McKenna

**(3) commercial aluminum.**

- 1891: 22 Regelsberger

**(4) commercial copper.**

- 1882: 13 Löwe  
 1900: 12 Truchot

**(5) commercial nickel.**

- 1894: 3 Fleitmann

**(6) ferromanganese.**

- 1870: 8 Rowan  
 1877: 12 Kern  
 1878: 2 Deshayes.  
 1879: 6 Kessler  
 1885: 12 Kalmann and Smolka  
 1891: 21 Pattinson  
 1895: 15 v. Jüptner  
 1896: 10 v. Jüptner

**(7) flue deposits.**

- 1890: 7 Jensch

**(8) food stuffs.**

- 1888: 17 Stein

**(9) German silver.**

- 1888: 12 Oettel

**(10) glass.**

- 1846: 3 Rowney

**(11) irons.**

- 1853: 8 Morfit and Booth  
 1862: 1 Abel  
 1863: 3 Lippert  
 1866: 2 Eggertz  
 1867: 4 Tosh  
 1872: 8 Pichard  
 1873: 1 Brünner  
 1874: 1 Koppmayer  
 1874: 3 Piesse  
 1874: 6 Willis  
 1875: 2 Kern  
 1876: 4 Kern  
 1876: 5 Peters  
 1877: 8 Deby  
 1878: 2 Deshayes  
 1879: 7 Ledebur  
 1881: 8 Ford  
 1881: 18 Williams  
 1882: 10 Keiser  
 1883: 1 Goetz  
 1883: 17 Schoeffel and Donath  
 1884: 3 Bloxam  
 1885: 3 Cheever  
 1886: 12 Deane

# 112 BIBLIOGRAPHY OF ANALYTICAL CHEMISTRY OF MANGANESE

## (11) irons—Continued.

- 1886: 26 Sprenger
- 1887: 1 Babbitt
- 1887: 16 Morgan
- 1887: 18 ———
- 1887: 19 ———
- 1888: 13 Reinhardt
- 1888: 20 Weismann
- 1888: 21 ———
- 1890: 6 Hellman
- 1891: 2 Blum
- 1891: 4 Brown
- 1891: 24 Rossi
- 1891: 25 Rubricius
- 1892: 12 v. Reis
- 1892: 17 Rubricius
- 1893: 10 Julian
- 1895: 7 Forestier
- 1895: 19 Ulzer and Brüll
- 1896: 11 Mignot
- 1896: 13 Murkewitsch
- 1896: 14 Rurup
- 1898: 6 Ford and Bregowsky
- 1898: 16 Murmann
- 1899: 8 Herting
- 1900: 10 Mignot

## (12) iron ores.

- 1866: 2 Eggertz
- 1872: 8 Pichard
- 1873: 1 Brunner
- 1874: 1 Koppmayer
- 1878: 9 Funaro
- 1877: 9 Ledebur
- 1879: 9 Pattinson
- 1879: 10 Pattinson
- 1883: 23 Zulkowsky
- 1885: 12 Kalmann and Smolka
- 1886: 1 Atkinson
- 1887: 3 Blair
- 1890: 13 Myhlertz
- 1891: 19 Norris
- 1891: 21 Pattinson
- 1897: 1 Auchy
- 1898: 6 Ford and Bregowsky

## (13) manganese bronze.

- 1894: 5 Jones

## (14) manganese phosphides.

- 1897: 8 Granger

## (15) manganic acid.

- 1824: 1 Frommherz

## (16) meteorites.

- 1879: 12 Pellitz

## (17) mineral or sea waters.

- 1841: 2 Henry
- 1876: 2 Fresenius
- 1889: 5a Gooch and Whitfield
- 1899: 11 Natterer

## (18) plants.

- 1897: 11 Lemaire
- 1898: 18 Pichard

## (19) Pyrolusite (and other manganese ores) See "Quantitative Determination of Manganese Peroxide."

## (20) slags or silicates.

- 1881: 10 Iles
- 1883: 8 Knop
- 1884: 10 Iles
- 1888: 6 Iles
- 1889: 5 Friedburg
- 1890: 13 Myhlertz
- 1891: 19 Norris
- 1891: 20 Namias
- 1900: 3 Hillebrand

## (21) soils.

- 1890: 2 van Benmeln
- 1897: 2 van Benmeln
- 1898: 18 Pichard

## (22) spiegeleisen.

- 1870: 4 Parker
- 1870: 8 Rowan
- 1874: 4 Parry
- 1874: 6 Willis
- 1875: 2 Kern
- 1875: 4 Morrell
- 1876: 3 Galbraith
- 1877: 8 Deby
- 1877: 12 Kern
- 1877: 18 Riley
- 1877: 20 Stöckmann
- 1878: 2 Deshayes
- 1879: 6 Kessler
- 1879: 9 Pattinson
- 1879: 10 Pattinson
- 1881: 8 Ford
- 1883: 19 Stone
- 1884: 2 Atkinson
- 1884: 3 Bloxam

**(22) spiegeleisen—Continued.**

- 1884: 8 Holdich
- 1884: 16 Stone
- 1885: 12 Kalmann and Smolka
- 1891: 21 Pattinson
- 1893: 9 Jean
- 1897: 3 Brearley

**(23) steels.**

- 1867: 2 Forbes
- 1872: 8 Pichard
- 1873: 1 Brünner
- 1874: 1 Koppmayer
- 1875: 1 Boussingault
- 1875: 2 Kern
- 1876: 5 Peters
- 1877: 8 Deby
- 1878: 2 Deshayes
- 1878: 6 Müller
- 1878: 7 Prochaska
- 1879: 9 Pattinson
- 1879: 10 Pattinson
- 1879: 14 Volhard
- 1880: 4 Dunston
- 1881: 7 Emmerton
- 1881: 9 Forguignon
- 1881: 11 Kent
- 1881: 17 Troilius
- 1881: 18 Williams
- 1882: 4 Dewey
- 1882: 10 Keiser
- 1883: 17 Schoeffel and Donath
- 1885: 3 Cheever
- 1886: 26 Sprenger
- 1887: 1 Babbitt
- 1887: 16 Morgan
- 1887: 18 ———
- 1887: 19 L'Assemblée Rep.  
Fab. Rails.
- 1888: 7 Julian
- 1888: 20 Weissmann
- 1888: 21 ———
- 1891: 2 Blum
- 1891: 24 Rossi
- 1891: 25 Rubricius
- 1895: 7 Forestier
- 1896: 7 Giorgis
- 1896: 11 Mignot
- 1896: 13 Murkewitsch
- 1896: 14 Rürup

1900: 6 Ibbotson and Brearley

1900: 7 Jervis

1900: 10 Mignot

**(24) tungsten alloys.**

1890: 18 Ziegler

1900: 5 Ibbotson and Brearley

1900: 7 Jervis

1900: 9 McKenna

**(25) Weldon mud.**

1874: 5 Pouchet

1875: 3 Lunge

1880: 8 Jurisch

1880: 11 Lunge

1880: 14 Post

1881: 12 Lunge

1889: 10 McKellar

**(26) wolframite.**

1890: 15 Selik

**(G) MISCELLANEOUS NOTES.****(a) Determination of the state of oxidation of manganese.**

1841: 1 Berzelius

1842: 1 Lea

1861: 3 Mohr

1876: 6 Phipson

**(b) Study of the oxides of manganese.**

1878: 9 Wright and Luff

1880: 17 Wright and Menke

1880: 19 Veley

**(c) Effect of copper on precipitation of manganese.**

1870: 4 Parker

**(d) Effect of organic acids and grape sugar on precipitation of manganese.**

1858: 4 Spiller

1869: 4 How

1882: 12 Lefort and Thiebault

**(e) Use of mercuric chloride to aid filtration of sulphide.**

1898: 15 Murmann

**(f) Use of powdered glass in basic acetate separation from iron.**

1890: 17 Warren

- (g) Filtration aided by addition of a concentrated solution of sodium acetate.

1888: 16 Schürmann

- (h) Destruction of organic matter by means of barium peroxide before titration with permanganate.

1887: 4 Brand

1892: 12 v. Reis

- (i) Determination of moisture in the analysis of pyrolusite.

1855: 3 Fresenius

- (j) Use of hydrofluoric acid to hold silicic acid in solution.

1891: 19 Norris

1898: 6 Ford and Bregowsky

1900: 5 Ibbotson and Brearley.

## QUANTITATIVE DETERMINATION OF MANGANESE PEROXIDE.

### I. By evolution of chlorine, and absorption in solutions of

- (a) alkaline hydroxides and determination of the hypochlorite formed.

1829: 1 Gay-Lussac

1835: 1 Gay-Lussac

1844: 1 Ettling

1869: 10 Sherer and Rumpf

1870: 10 Sherer and Rumpf

1870: 12 Tissandier

1877: 16 Perrey

- (b) arsenious acid.

1853: 10 Price

1860: 4 Machnea

- (c) ferrous sulphate.

1831: 3 Turner

1842: 4 Otto

1867: 1 Braun

1868: 3 Lunge

1869: 8 Prior

1885: 2 Charpentier

- (d) potassium iodide, and titration of iodine.

1853: 1 Bunsen

1853: 5 Krieger

1861: 4 Möller

1869: 10 Sherer and Rumpf

1870: 1 Fresenius

1870: 5 Pattinson

1870: 10 Sherer and Rumpf

1877: 15 Parreño

1877: 16 Perrey

1879: 11 Pickering

1881: 13 Lunge

1888: 9 de Koninck and Lécrenier

- (e) silver nitrate.

1843: 1 Baumann

- (f) stannous chloride.

1851: 2 Müller

- (g) sulphurous acid (precipitation of barium sulphate).

1832: 3 Duflos

1832: 4 Duflos

1837: 2 Ebelmen

1838: 1 Gieseler

1874: 5 Pouchet

### II. By solution in presence of a reducing agent.

- (a) antimonious chloride.

1872: 5 Kessler

- (b) arsenious acid.

1898: 2 Bialobzski

- (c) ferrous salts.

1842: 2 Levöl

1847: 2 Levöl

1851: 4 Schabus

1856: 2 Schreiner

1869: 11 Teschenmacher and Smith

1870: 5 Pattinson

1877: 10 Hannay

1880: 11 Lunge

1881: 16 Terreil

1889: 4 Finkener

1889: 10 M'Kellar

- (d) formic acid (with absorption of carbon dioxide).

1833: 1 Göbel

- (e) oxalates (with absorption of carbon dioxide).

1843: 3 Fresenius and Will

1847: 6 De Vry

1861: 2 Kolbe

**(e) oxalates—Continued.**

- 1863: 1 Fresenius  
 1869: 6 Mohr  
 1869: 10 Sherer and Rumpf  
 1869: 11 Teschenmacher and Smith  
 1870: 5 Pattinson  
 1870: 10 Sherer and Rumpf  
 1871: 4 Luck  
 1877: 16 Perry  
 1881: 13 Lunge  
 1882: 3 Darton  
 1890: 1 Baumann

**(f) oxalic acid (volumetric).**

- 1870: 6 Paul  
 1889: 4 Finkener

**(g) potassium iodide and acid.**

- 1858: 1 Hempel  
 1882: 5 Diehl  
 1883: 5 Hempel

**(h) stannous chloride.**

- 1865: 1 Alfraise  
 1883: 3 Harvey

**III. By gasometric methods. Measurement of****(a) carbon dioxide.**

- 1832: 1 Berthier  
 1833: 3 Zenneck

**(b) nitrogen.**

- 1832: 1 Berthier  
 1833: 3 Zenneck  
 1897: 14 Purgotti

**(c) oxygen evolved from hydrogen peroxide.**

- 1885: 13 Lunge  
 1890: 1 Baumann  
 1890: 9 Lunge  
 1890: 10 Lunge  
 1890: 11 Lunge  
 1893: 3 Carnot  
 1893: 4 Carnot  
 1894: 7 Kippenberger  
 1894: 8 Lunge  
 1895: 3 Bodländer

**(d) oxygen expelled on ignition.**

- 1833: 3 Zenneck

**IV. By loss of weight of metallic copper.**

- 1839: 1 Fikentscher

- 1839: 2 Fuchs  
 1851: 3 Personne and Lhermite  
 1859: 1 Fikentscher  
 1859: 2 Nolté  
 1861: 5 Quadrat  
 1864: 5 ———

**V. By fusion with chromic oxide and alkali.**

- 1882: 17 Wagner

**VI. By the method of****(a) Bunsen.**

- 1853: 1 Bunsen  
 1853: 5 Krieger  
 1861: 4 Möller  
 1869: 10 Sherer and Rumpf  
 1870: 1 Fresenius  
 1870: 5 Pattinson  
 1870: 9 Sherer  
 1870: 10 Sherer and Rumpf  
 1874: 5 Pouchet  
 1877: 16 Perrey  
 1880: 13 Pattinson  
 1881: 13 Lunge  
 1889: 4 Finkener

**(b) Fresenius and Will.**

- 1843: 8 Fresenius and Will  
 1847: 6 De Vry  
 1862: 2 Röhr  
 1863: 1 Fresenius  
 1869: 6 Mohr  
 1869: 10 Sherer and Rumpf  
 1869: 11 Teschenmacher and Smith  
 1870: 5 Pattinson  
 1870: 9 Sherer  
 1870: 10 Sherer and Rumpf  
 1871: 4 Luck  
 1874: 5 Pouchet  
 1877: 16 Perry  
 1881: 13 Lunge  
 1890: 1 Baumann

**(c) Gay-Lussac.**

- 1829: 1 Gay-Lussac  
 1836: 3 Wittstein  
 1844: 1 Ettling  
 1860: 4 Machnea  
 1877: 16 Perry  
 1893: 9 Jean

**(d) Lunge (gasometric).**

- 1885: 13 Lunge  
 1890: 1 Baumann  
 1890: 9 Lunge  
 1890: 10 Lunge  
 1890: 11 Lunge  
 1893: 3 Carnot  
 1893: 4 Carnot  
 1894: 8 Lunge

**(e) Nolté.**

- 1859: 2 Nolté  
 1864: 5 ———

**VII. Modification of apparatus for the method of****(a) Bunsen.**

- 1888: 5 de la Harpe and Réverdin  
 1894: 1 Christomanos  
 1894: 17 Ullmann

**(b) Gay-Lussac.**

- 1847: 1 Bobierre  
 1878: 5 Morawski and Stingl

**(c) Lunge.**

- 1890: 11 Lunge  
 1894: 7 Kippenberger

**(d) loss of weight on evolution of carbon dioxide from oxalic acid.**

- 1898: 17 Northomb

**QUALITATIVE DETECTION OF MANGANESE.****Detection by means of****(a) ammonium thiosulphate.**

- 1883: 12 Orłowski

**(b) fusion with alkalis.**

- 1785: 1 Hjelm  
 1836: 1 Kraskowitz  
 1836: 2 Thomson  
 1852: 1 Chapman  
 1854: 1 Davy  
 1877: 2 Chapman  
 1889: 19 Wells and Vulté

**(c) fusion with silica and the alkalis.**

- 1878: 1 Bong

**(d) blow-pipe bead tests.**

- 1820: 1 Gahn

**(e) blow-pipe reactions.**

- 1866: 1 Bunsen  
 1877: 2 Chapman

**(f) bromate or bromine.**

- 1897: 5 Cushman  
 1898: 20 Vitali

**(g) hydrogen peroxide.**

- 1888: 8 Klein  
 1889: 6 Klein

**(h) formation of metaphosphate.**

- 1815: 1 John

**(i) microchemical tests.**

- 1886: 3 Behrens  
 1887: 8 Haushofer  
 1891: 1 Behrens  
 1892: 8 Frey  
 1899: 12 Pozzi-Escot

**(j) oxidation to permanganic acid.**

- 1845: 2 Crum  
 1852: 2 Gibbs  
 1853: 3 Heizel  
 1853: 6 Löwe  
 1858: 3 Rose  
 1870: 7 Polacci  
 1883: 2 Guyard  
 1884: 14 Maumené  
 1886: 7 Christensen  
 1895: 1 Alvarez and Jean  
 1898: 19 Pichard

**(k) ozone.**

- 1847: 5 Schönbein

**(l) phosphoric acid.**

- 1846: 2 Phillips  
 1857: 1 Barreswil  
 1859: 3 Von Kobell  
 1867: 1 Braun  
 1876: 1 Campani  
 1881: 14 v. Reis  
 1885: 1 Bloxam

**(m) fusion with potassium chlorate.**

- 1857: 2 Böttger  
 1872: 2 Böttger  
 1880: 1 Böttger

**(n) potassium ferricyanide.**

- 1885: 6 Dean  
 1885: 8 Draper

**(o) potassium ferrocyanide.**

- 1850: 1 Davy



(o) **potassium ferrocyanide**—*Continued.*

1854: 1 Davy

(p) **sodium hypobromite.**

1892: 6 Deniges

(q) **sodium peroxide.**

1893: 7 Hempel

(r) **spectrum analysis.**

1862: 3 Simmler

1872: 4 Horner

1875: 5 Vogel

1880: 12 Parry and Tucker

1898: 10 de Gramont

(s) **lead peroxide.**

1889: 8 de Koninck

(t) **separation from iron by means of nitrites.**

1897: 17 Wynkoop

## AUTHOR INDEX.

- |   |  |
|---|--|
| <p>Abel, F., A., 1862: 1<br/>         Alfvers, F. See Jannasch and Alfvers.<br/>         Alfraise, P., 1865: 1<br/>         Allen, A. H., 1871: 1; 1872: 1<br/>         Aller, 1892: 1<br/>         Alt, H., 1889: 1<br/>         Alvarez, P., and Jean F., 1895: 1<br/>         Anger, C., 1884: 1<br/>         Assemblée rep. fab. rails., 1887: 1<br/>         Atkinson, A. J., 1884: 2<br/>         Atkinson, R. W., 1886: 1<br/>         Auchy, G., 1895: 2; 1896: 1; 1897: 1<br/>         Austin, M., 1898: 1. See also Gooch and Austin.</p> <p>Babbitt, H. C., 1887: 1<br/>         Barlow, J. J., 1886: 2<br/>         Barreswil, 1846: 1; 1857: 1<br/>         Bastin, C., 1892: 2<br/>         Bauman, H., 1843: 1<br/>         Baumann, A., 1890: 1<br/>         Bayley, T., 1887: 2<br/>         Becquerel, 1830: 1<br/>         Behrens, T. H., 1886: 3; 1891: 1<br/>         Beilstein, F., and Jawein, L., 1879: 1; 1881: 1<br/>         Bein, S., 1886: 4<br/>         Berthier, P., 1832: 1<br/>         Berzelius, J., 1806: 1; 1841: 1<br/>         Bialobzcski, M., 1898: 2<br/>         Blair, A. A., 1887: 3<br/>         Bloxam, C. L., 1884: 3; 1885: 1<br/>         Blum, L., 1886: 5; 1889: 2; 1891: 2; 1891: 3; 1892: 3<br/>         Bobierre, W., 1847: 1<br/>         Bodländer, G., 1895: 3<br/>         Böttger, R., 1857: 2; 1872: 2; 1880: 1<br/>         Böttger, W., 1900: 1<br/>         de Boisbaudran, L., 1882: 1<br/>         Bolton, H. C., 1875: 1a; 1877: 1</p> | <p>Bong, G., 1878: 1<br/>         Booth, J. C. See Morfit and Booth.<br/>         Boussingault, 1875: 1<br/>         Boyd, R. C., 1890: 3<br/>         Brand, A., 1887: 4; 1889: 3<br/>         Brandes, R., 1819: 1<br/>         Braun, C. D., 1867: 1; 1868: 1<br/>         Brearley, H., 1897: 3; 1897: 4; 1898: 3; 1899: 1; 1899: 2; 1899: 3. See also Ibbotson and Brearley.<br/>         Bregowsky, J. M. See Ford and Bregowsky.<br/>         Brown, D. H., 1891: 4<br/>         Brühl, E. See Friedheim and Brühl.<br/>         Brüll, J. See Ulzer and Brüll.<br/>         Brünner, A., 1873: 1<br/>         Bucholz, 1811: 1<br/>         Bunsen, R., 1853: 1; 1866: 1<br/>         Burgass, R., 1896: 2<br/>         Büttgenbach, F., 1896: 3</p> <p>Cabot, J. W., 1882: 2<br/>         Camilla, S. See Longi and Camilla.<br/>         Campani, G., 1876: 1<br/>         Campbell, A. C., 1888: 1<br/>         Campbell, E. D. See Hess and Campbell.<br/>         Campredon, L., 1892: 4; 1898: 4<br/>         Carnot, A., 1879: 2; 1886: 6; 1887: 6; 1888: 2; 1890: 4; 1893: 1; 1893: 2; 1893: 3; 1893: 4; 1895: 4<br/>         Chapman, 1852: 1<br/>         Chapman, E. J., 1877: 2<br/>         Charpentier, P., 1885: 2<br/>         Chatard, T. M., 1871: 2<br/>         Cheever, B. W., 1885: 3; 1886: 8; 1887: 5<br/>         Chemiker-Commission der Verein deutscher Eisenhüttenleute, 1891: 5; 1892: 5</p> |
|---|--|

- Christensen, O. T., 1886: 7  
 Christomanos, A. C., 1894: 1  
 Clark, J., 1893: 5  
 Classen, A., 1869: 1; 1877: 3; 1877: 4;  
     1877: 5; 1877: 6; 1877: 7; 1879: 3;  
     1879: 4; 1879: 5; 1881: 2; 1884: 4;  
     1884: 5; 1885: 4; 1885: 5; 1886: 9;  
     1886: 10; 1894: 2  
 Classen, A., and Ludwig, R., 1886: 11  
 Classen, A., and v. Reis, 1881: 3  
 von Cloedt, E. See Jannasch and v.  
     Cloedt.  
 Cloez, 1845: 1  
 Crookes, W., 1864: 1  
 Crum, W., 1845: 2  
 Cushman, A. R., 1897: 5  
  
 Dakin, H. D., 1900: 2  
 Damour, 1869: 2  
 Darton, N. H., 1882: 3  
 Davy, E., 1850: 1; 1854: 1  
 Davy, J., 1814: 1  
 Daw, F. W., 1899: 4  
 Deane, L. M., 1885: 6; 1886: 12  
 Deby, 1877: 8  
 Delffs, H., 1880: 2  
 Delvaux, G., 1881: 4  
 Demarçay, 1834: 1  
 Deniges, 1892: 6; 1898: 4a  
 Deshayes, V., 1878: 2; 1881: 5  
 Deville, H. St.-C., 1853: 1a  
 Devisse, N., 1897: 6  
 Dewey, F. P., 1882: 4; 1896: 4  
 Diehl, W., 1882: 5; 1885: 7  
 Döbereiner, 1832: 2; 1837: 1  
 Donath, E., 1881: 6; 1891: 6; 1891: 7;  
     1892: 7. See also Schoeffel and  
     Donath.  
 Donath, E., and Zeller, R., 1887: 7.  
 Draper, C. N., 1885: 8  
 Drown, T. M., and Shimer, P. W.,  
     1880: 3  
 Dubois, H. W. See Mixer and Dubois  
 Dudley, C. B., 1896: 5  
 Duflos, A., 1832: 3; 1832: 4  
 Du Menil, 1827: 1  
 Dunn, J. D., 1882: 6  
 Dunnington, F. P., 1899: 5  
 Dunston, W. R., 1880: 4  
  
 Ebelmen, 1837: 2; 1843: 2; 1849: 1  
 Eggertz, V., 1866: 2  
 Emmerton, F. A., 1881: 7  
 Engels, C., 1895: 5; 1895: 6; 1897: 7  
 Engels, M., 1896: 6; 1898: 5  
 Ettling, 1844: 1  
  
 Faraday, M., 1819: 2  
 Fernberger, H. M., and Smith, E. F.,  
     1899: 6  
 Field, F., 1857: 3; 1860: 1  
 Fikentscher, F. C., 1839: 1; 1859: 1  
 Finkener, 1890: 4  
 Flajolot, 1853: 2  
 Fleitmann, J., 1894: 3  
 Forbes, D., 1867: 2  
 Ford, A. P., and Bregowsky, J. M.,  
     1898: 6  
 Ford, S. A., 1881: 8  
 Forestier, H., 1895: 7  
 Forguignon, 1881: 9  
 Fränkel, L. K. See Smith and Frän-  
     kel.  
 Franzek, C. J. See Jannasch and  
     Franzek.  
 Fresenius, R., 1855: 3; 1861: 1;  
     1863: 1; 1864: 2; 1870: 1; 1872: 3;  
     1876: 2  
 Fresenius, R., and Hintz, E., 1890: 5  
 Fresenius, R., and Will, H., 1843: 3  
 Frey, 1892: 8  
 Friedburg, L. H., 1889: 5  
 Friedheim, C., and Brüll, E., 1899: 7  
 Friedmann, A., 1888: 3  
 Fröhde, A., 1866: 3  
 Frommherz, C., 1824: 1  
 Fuchs, J. N., 1831: 1; 1839: 2  
 Funaro, A., 1877: 9  
 Fuss, W. E., 1830: 2  
  
 Gahn, 1820: 1  
 Galbraith, W., 1876: 3  
 Galetti, M., 1869: 3  
 Gay-Lussac, 1829: 1; 1835: 1  
 Ghilian, A., 1888: 4  
 Gibbs, W., 1852: 2; 1864: 3; 1865: 2;  
     1867: 3; 1870: 2; 1873: 2  
 Gieseler, 1838: 1  
 Giorgis, G., 1896: 7

## 120 BIBLIOGRAPHY OF ANALYTICAL CHEMISTRY OF MANGANESE

- Gmelin, O., 1884: 6  
 Göbel, 1833: 1  
 Goetz, 1883: 1  
 Gooch, F. A., and Austin, M., 1898: 7;  
 1898: 8; 1898: 9  
 Gooch, F. A., and Whitfield, J. E.,  
 1889: 5a  
 Gorgeu, A., 1860: 2; 1893: 6  
 de Gramont, A., 1898: 10  
 Granger, A., 1897: 8  
 Gröger, M., 1895: 8  
 Grotthuss, T., 1817: 1  
 Gurlt, A., 1856: 1  
 Guyard, A., 1863: 2; 1882: 7; 1883: 2  
  
 Habich, R., 1865: 3  
 Hambly, F. J. See Thorpe and Hambly.  
 Hampe, W., 1883: 4; 1885: 9; 1885:  
 10; 1891: 8; 1891: 9; 1892: 9  
 Handy, J. O., 1896: 7a  
 Hannay, J. B., 1877: 10  
 Hanowsky, 1884: 7  
 de la Harpe, C., and Réverdin, F.,  
 1888: 5  
 Harvey, J. W. C., 1883: 3  
 Haswell, A. E., 1880: 5; 1882: 8  
 Hatchett, 1813: 1  
 Haushofer, 1887: 8  
 Heizel, 1853: 3  
 Hellman, C. G., 1890: 6  
 Hempel, W., 1853: 4; 1858: 1; 1883: 5;  
 1893: 7  
 Henry, T. H., 1841: 2; 1858: 2  
 Hermbstadt, 1792: 1  
 Herschell, J. F. W., 1821: 1  
 Herting, O., 1899: 8  
 Hess, W. H., and Campbell, E. D.,  
 1899: 9  
 Heyl, P. See Smith and Heyl.  
 Hillebrand, W. F., 1897: 8a; 1898: 11;  
 1900: 3  
 Hintz, E. See Fresenius and Hintz.  
 Hiorns, A., 1900: 4  
 Hjelm, P. J., 1785: 1  
 Holdich, 1884: 8  
 Holthoff, C., 1884: 9  
 Horner, 1872: 4  
 How, 1869: 4.  
 Hunt, A. E., 1886: 13  
  
 Ibbotson, F., and Brearley, H., 1900: 5  
 1900: 6  
 Iles, M. W., 1881: 10; 1884: 10;  
 1888: 6  
  
 Jannasch, P., 1896: 8  
 Jannasch, P., and Alffers, F., 1898: 12  
 Jannasch, P., and v. Cloedt, E., 1895: 9  
 1895: 10; 1895: 11  
 Jannasch, P., and Franzek, C. J.,  
 1891: 10  
 Jannasch, P., and Kammerer, H.,  
 1895: 12; 1895: 13  
 Jannasch, P., and Lehnert, H., 1896: 9  
 Jannasch, P., and MacGregory, J. F.,  
 1891: 11  
 Jannasch, P., and Niederhofheim,  
 1891: 12  
 Jannasch, P., and Röttgen, A., 1895: 14  
 Jawein, L. See Beilstein and Jawein.  
 Jean, F., 1893: 8; 1893: 9. See also  
 Alvarez and Jean.  
 Jensch, E., 1890: 7  
 Jervis, H., 1900: 7  
 Jewett, J., 1880: 6; 1882: 9  
 John, J. F., 1806: 2; 1815: 1  
 Jolles, A., 1887: 9  
 Jones, H. C., 1894: 4; 1894: 5  
 Joüet, C. H., 1900: 8  
 Juette, M., 1868: 2  
 Julian, F., 1888: 7; 1893: 10; 1897: 9  
 v. Jüptner, H., 1880: 7; 1883: 6;  
 1885: 11; 1895: 15; 1896: 10  
 Jurisch, K., 1880: 8  
  
 Kaepfel, F., 1898: 13  
 Kalmann, W., and Smolka, A.  
 1885: 12  
 Kammerer, H., 1871: 3. See also  
 Jannasch and Kammerer.  
 Kassner, O., 1894: 6.  
 Kastner, 1832: 5  
 Keiser, E. H., 1882: 10  
 Kent, W., 1881: 11  
 Kerl, B., 1883: 7  
 Kern, S., 1875: 2; 1876: 4; 1877: 11;  
 1877: 12  
 Kessler, F., 1872: 5; 1872: 6; 1879: 6  
 Kirwan, 1797: 1

- Kippenberger, C., 1894: 7  
 Klein, J., 1888: 8; 1889: 6  
 Klobb, T., 1887: 10  
 Knop, W., 1883: 8  
 v. Knorre, G., 1887: 11; 1887: 12  
 v. Kobell, 1859: 3  
 Kohn, C. J., and Woodgate, J., 1889: 7  
 Kolbe, H., 1861: 2  
 de Koninck, L. L., 1880: 9; 1889: 8;  
 1890: 8  
 de Koninck, L. L., and Lecrenier, A.,  
 1888: 9  
 Koppmayer, M., 1874: 1  
 Kosman, B., 1893: 11  
 Kramer, C., 1877: 13  
 Kraskowitz, 1836: 1  
 Krieger, 1853: 5
- Laming, R., 1851: 1  
 Langbein, E., 1886: 14  
 Lassaigue, 1829: 2  
 Lax, E., 1887: 13  
 Lea, H. C., 1842: 1  
 Leclerc, A., 1872: 7  
 Lecrenier, A. See de Koninck and  
 Lecrenier.  
 Ledebur, A., 1879: 7; 1882: 11; 1884:  
 11  
 Lefort, J., and Thebault, P., 1882: 12  
 Lehnert, H. See Jannasch and Leh-  
 nert.  
 Lehnkering, P., 1898: 14  
 Leison, W. G., 1870: 3  
 Lemaire, M., 1897: 11  
 Lennsen, E., 1860: 3  
 LeRoy, G. A., 1891: 15  
 Levöl, 1842: 2; 1847: 2  
 Lhermite. See Personne and Lher-  
 mite.  
 Liebig, J., 1831: 2; 1832: 6; 1841: 3  
 Lippert, G., 1863: 3  
 Longi, A., and Camilla, S., 1897: 10  
 Lösekann, G., and Meyer, T., 1886: 14a  
 Low, A. H., 1893: 12  
 Löwe, J., 1853: 6; 1882: 13  
 Löwenthal, J., 1853: 7  
 Luck, E., 1871: 4  
 Luckow, C., 1865: 4; 1869: 5; 1880: 10;  
 1891: 13; 1891: 14
- Ludwig, R. See Classen and Ludwig.  
 Luff. See Wright and Luff.  
 Lunge, G., 1868: 3; 1875: 3; 1880: 11;  
 1881: 12; 1881: 13; 1885: 13; 1890: 9;  
 1890: 10; 1890: 11; 1894: 8
- MacGregory, J. F. See Jannasch and  
 MacGregory.  
 Machnea, M., 1860: 4  
 Mackintosh, B., 1883: 9  
 Mackintosh, J. B., 1879: 8; 1884: 12;  
 1884: 13  
 Martini, 1829: 3  
 Mathesius, W., 1885: 14  
 Mathews, J. A. See Miller and  
 Mathews.  
 Matzurke, G., 1878: 3  
 Maumene, E. J., 1884: 14  
 Mayer, F., 1889: 9  
 McCulloch, N., 1889: 11; 1889: 12  
 M'Kellar, W. G., 1889: 10  
 McKenna, A. G., 1890: 12; 1900: 9  
 Meineke, C., 1883: 10; 1883: 11; 1884:  
 15; 1885: 15; 1886: 15; 1887: 14;  
 1887: 15; 1888: 10  
 Menke, A. E. See Wright and Menke.  
 Meyer, T. See Lösekann and Meyer.  
 Mignot, A., 1896: 11; 1900: 10  
 Miller, E. H., 1897: 12  
 Miller, E. H., and Mathews, J. A.,  
 1897: 13  
 Mills, E. J., and Becket, J. H., 1882: 14  
 Mittenzwey, M., 1864: 4  
 Mixer, C. T., and Dubois, H. W.,  
 1896: 12  
 Möller, 1861: 4  
 Mohr, F., 1855: 1; 1861: 3; 1869: 6  
 Moldenhauer, F., 1889: 13; 1891: 16;  
 1891: 17  
 Moore, T., 1886: 18; 1886: 19;  
 1888: 11; 1891: 18; 1892: 10  
 Morawski, T., and Stingl, J., 1878: 4;  
 1878: 5; 1887: 16  
 Morgan, J. J. See Parry and Morgan.  
 Morfit, C., and Booth, J. C., 1832: 8  
 Morrell, T. T., 1874: 2; 1875: 4  
 Muck, 1869: 7  
 Müller, C. G., 1851: 2; 1886: 16;  
 1886: 17

# 122 BIBLIOGRAPHY OF ANALYTICAL CHEMISTRY OF MANGANESE

- Müller, F. C. G., 1878: 6  
Müller, L., 1855: 2  
Munroe, C. E., 1877: 14  
Murkewitsch, M., 1896: 13  
Murmman, E., 1898: 15; 1898: 16  
Myhlertz, F. G., 1890: 13
- Namias, R., 1891: 20; 1899: 10  
Nass, G., 1894: 9  
Natterer, K., 1899: 11  
Neumann, B., 1895: 16; 1896: 13a  
Neumann, G., 1889: 14; 1894: 10  
Niederhofheim. See Jammasch and Niederhofheim.  
Nolté, G., 1859: 2  
Norris, G. L., 1891: 19  
Northomb, M., 1898: 17
- Oettel, F., 1888: 12  
Orlowski, A., 1883: 12  
Osmond, 1885: 16  
Otto, 1842: 3; 1842: 4
- Parker, J. S., 1870: 4  
Parkinson, 1853: 9  
Parreño, A. G., 1877: 15  
Parry, J., 1874: 4  
Parry, J., and Morgan, J. J., 1893: 13  
Parry, J., and Tucker, A. E., 1880: 12  
Pattinson, J., 1870: 5; 1879: 9; 1879: 10; 1880: 13; 1886: 20  
Pattinson, J., and H. S., 1891: 21; 1900: 11  
Paul, B. H., 1870: 6  
Pellitz, W., 1879: 12  
Perillou, 1886: 21  
Perrey, 1877: 16  
Personne and Lhermite, 1851: 3  
Persoz, J., 1835: 2  
Peters, S., 1876: 5  
Pfaff, C. H., 1812: 1; 1819: 3; 1821: 2  
Phillips, R., 1846: 2  
Phipson, T. L., 1876: 6  
Pichard, P., 1872: 8; 1898: 18; 1898: 19  
Pickering, S. U., 1879: 11  
Piesse, C. H., 1874: 3  
Planiawa, 1833: 2  
Poleck, T., 1894: 11
- Pollacci, E., 1870: 7  
Porcel, 1788: 1  
Post, J., 1880: 14  
Pouchet, A. G., 1874: 5  
Pozzi-Escot, M. E., 1899: 12  
Price, 1853: 10  
Prior, M. E., 1869: 8  
Priwoznik, 1892: 11  
Prochaska, J., 1878: 7  
Purgotti, A., 1897: 14
- Quadrat, B., 1861: 5  
Quesneville, Jr., 1827: 2
- Radau, C., 1889: 15  
Raimond, E., 1883: 13  
Ramage, H. See Reddrop and Ramage.  
Reddrop, J., and Ramage, H., 1895: 17  
Regelsberger, F., 1891: 22  
Reichard, C., 1899: 13; 1899: 14  
Reichardt, E., 1866: 4  
Reinhardt, C., 1885: 17; 1885: 18; 1886: 22; 1886: 23; 1887: 17; 1888: 13  
v. Reis, M. A., 1881: 14; 1888: 14; 1891: 23; 1892: 12; 1892: 13. See also Classen and v. Reis.  
Reitmair, O., 1889: 16  
Renard, A., 1869: 9  
Réverdin, F. See de la Harpe and Réverdin.  
de Rezende, 1872: 9  
Riban, J., 1890: 14  
Riche, A., 1878: 8  
Riche, M. A., 1877: 17  
Richter, 1796: 1  
Richter, W., 1837: 3  
Riederer, E. J., 1899: 15  
Riggs, R. B., 1892: 14  
Riley, E., 1877: 18  
Rinmann, S., 1786: 1  
Rivot, 1853: 11  
Röhr, R., 1862: 2  
Rose, H., 1847: 3; 1858: 3; 1860: 5; 1860: 6; 1860: 7; 1861: 6  
Rosenthal, G., 1877: 19  
Rossi, A. J., 1891: 24  
Rössler, C., 1879: 13; 1880: 15

- Rothe, J. W., 1892: 15  
 Rottgen, A. See Jannasch and Röttgen.  
 Rowan, T., 1870: 8; 1871: 5  
 Rowney, T., 1846: 3  
 Rube, C., 1865: 5  
 Rubricius, H., 1891: 25; 1892: 16; 1892: 17  
 Rüdorff, F., 1892: 18; 1893: 14; 1894: 12  
 Rumpf, G. See Sherer and Rumpf.  
 Rürup, L., 1891: 26; 1896: 14  
  
 Saniter, E. H., 1894: 13  
 Särnström, C. G., 1881: 15; 1883: 14; 1883: 15  
 Schabus, 1851: 4  
 Scheerer, T., 1837: 4  
 Schiel, T., 1853: 12  
 Schlagdenhauffen, 1885: 19  
 Schmitt, 1883: 16  
 Schneider, L., 1888: 15; 1889: 17; 1892: 19; 1897: 15  
 Schöffel, R., and Donath, E., 1883: 17; 1886: 24  
 Schönbein, C. F., 1847: 5  
 Schreiner, E., 1856: 2  
 Schucht, 1883: 18  
 Schürmann, 1888: 16  
 Seeliger, R., 1894: 14  
 Setlik, B., 1890: 15  
 Setterwall, 1886: 25  
 Sherer, E., 1870: 9  
 Sherer, E., and Rumpf, G., 1869: 10; 1870: 10  
 Shimer, P. W. See Drown and Shimer  
 Simmler, T., 1862: 3  
 Smith. See Teschenmacher and Smith.  
 Smith, E. F., 1891: 27. See also Taggart and Smith, and Fernberger and Smith.  
 Smith, E. F., and Fränkel, L. K., 1889: 18  
 Smith, E. F., and Heyl, P., 1894: 15  
 Smolka, A. See Kalmann and Smolka.  
 Spiller, J., 1858: 4  
 Sprenger, 1886: 26  
  
 Stein, G., 1888: 17  
 Stingl, J. See Morawski and Stingl.  
 Stöckmann, C., 1877: 20  
 Stone, G. C., 1883: 19; 1883: 20; 1884: 16; 1896: 15  
 Stone, G. C., and van Ingen, D. A., 1897: 16  
 Strecker, 1847: 4  
 Streng, 1854: 2  
 Stromeyer, 1827: 3  
  
 Taggart, W. T., and Smith, E. F., 1896: 16  
 Talbott, J. H., 1870: 11  
 Tamm, A., 1882: 15  
 Tamm, H., 1871: 6; 1872: 9; 1872: 11  
 Terreil, A., 1857: 4; 1866: 5; 1868: 4; 1881: 16  
 Teschenmacher and Smith, 1869: 11  
 Thiebault, P. See Lefort and Thiebault.  
 Thomälen, H., 1894: 16  
 Thomas, W. S., 1895: 18  
 Thomson, 1836: 2  
 Thorpe, T. E., and Hambly, F. J., 1888: 18; 1888: 19  
 Tissandier, G., 1870: 12  
 T. J., 1899: 16  
 Tosh, E. G., 1867: 4  
 Troilius, M., 1881: 17; 1882: 16; 1883: 21  
 Truchot, P., 1900: 12  
 Tucker, A. E. See Parry and Tucker.  
 Turner, E., 1831: 3  
  
 Ukena, 1891: 28  
 Ullgren, 1841: 4  
 Ullmann, C., 1894: 17  
 Ulzer, F., and Brull, J., 1895: 19  
  
 Van Bemmelen, J. M., 1890: 21; 1897: 2  
 Van Grundy, C. P., 1892: 20  
 Van Ingen, D. A. See Stone and Van Ingen.  
 Vauquelin, 1799: 1  
 Veley, V. H., 1880: 19  
 Viard, G., 1896: 17  
 Vitali, D., 1898: 20



## 124 BIBLIOGRAPHY OF ANALYTICAL CHEMISTRY OF MANGANESE

Völker, A., 1846: 4  
 Vogel, H. W., 1875: 5  
 Volhard, J., 1879: 14  
 Vortmann, G., 1890: 16  
 Vulté, H. T. See Wells and Vulté.  
 deVry, 1847: 6

W., 1839: 3  
 Wackenroder, 1838: 2  
 Wagner, A., 1882: 17  
 Warrington, Jr., R., 1865: 6  
 Warren, H. W., 1890: 17  
 Warwick, H. S., 1892: 21  
 Weissmann, G., 1888: 20  
 Weldon, 1880: 16  
 Wells, J. S. C., and Vulté, H. T.,  
 1889: 19  
 Whitfield, J. E. See Gooch and Whit-  
 field.  
 Wieland, T., 1884: 17  
 Will, H. See Fresenius and Will.

Williams, F. A., 1881: 18  
 Willis, A., 1874: 6  
 Winckler, C., 1864: 6  
 Wittstein, G. C., 1836: 3  
 Wolff, N., 1883: 22; 1884: 18; 1885:  
 20; 1886: 27  
 Wolman, L., 1898: 21  
 Woodgate, J. See Kohn and Wood-  
 gate.  
 Wright, C. R. A., and Luff, 1878: 9  
 Wright, C. R. A., and Menke, A. E.,  
 1880: 17; 1880: 18  
 Wynkoop, G., 1897: 17  
  
 Zeller. See Donath and Zeller.  
 Zenneck, 1833: 3  
 Ziegler, A., 1890: 18  
 Zimmermann, C., 1880: 20  
 Zimmermann, R., 1886: 28  
 Zulkowsky, K., 1883: 23  
 ———, 1864: 5  
 ———, 1888: 21

SMITHSONIAN MISCELLANEOUS COLLECTIONS.

— 1314 —

CHEMICAL SOCIETIES  
OF THE  
NINETEENTH CENTURY.

BY

HENRY CARRINGTON BOLTON.



CITY OF WASHINGTON:  
PUBLISHED BY THE SMITHSONIAN INSTITUTION.

1902.

**The Knickerbocker Press, New York**

# CHEMICAL SOCIETIES OF THE XIX CENTURY.\*

BY HENRY CARRINGTON BOLTON, PH.D.

The beginning of a new century affords an opportune period for chronicling the progress of chemistry as shown by the organizations formed to foster its study and to stimulate its adherents. In the following pages an attempt has been made to place on record the statistics of the Chemical Societies of the World for the year 1900, and to indicate those that ended their careers within the nineteenth century. The data have been obtained chiefly by correspondence, and thanks are due to the officers of societies who have responded to inquiries. I am also under special obligations to Dr. Paul Dorveaux, Librarian of the École Supérieure de Pharmacie, Paris; to Professor Bohuslav Brauner, of the Bohemian University, Prague; to Professor George W. A. Kahlbaum, of the University of Basel; and particularly to the Smithsonian Institution, for aid in securing the information sought.

The fact that chemical societies were organized and in operation in the United States of America long before they existed in Europe has been shown in my paper, "Early American Chemical Societies," read to the Chemical Society of Washington, April 8, 1897. The two pioneers in this field were the "Chemical Society of Philadelphia," founded in 1792, and the "Columbian Chemical Society of Philadelphia," founded in 1811. Of these some particulars will be found in their proper order.

In the following list the societies are placed in chronological order under each country, and the countries are arranged alphabetically. Of each society the following data are given so far as attainable:

Seat, and date of founding,  
Name of President, and membership in 1900,†  
Serial publications,‡  
Remarks.

---

\* Read at the 25th Anniversary of the American Chemical Society held in New York City, April 12-13, 1901.

† No deductions have been made for duplication.

‡ For full details consult: A Select Bibliography of Chemistry, by Henry Carrington Bolton, Washington, 1893-1899. 3 vols. 8vo.

The results of this census are given in the following Table:

CHEMICAL SOCIETIES OF THE WORLD.

MEMBERSHIP IN 1900.

<i>Country.</i>	<i>No. of Societies.</i>	<i>No. of Members.</i>
Austria.....	7 .....	3,072
Belgium... ..	3 .....	740
France.....	10 .....	4,065
Germany.....	10 .....	7,559
Great Britain.....	9 .....	7,550
Italy.....	5 .....	479
Japan. ....	2 .....	1,012
Russia... ..	1 .....	327
South Africa.....	1 .....	(?)
Switzerland... ..	2 .....	94
United States America .	5 .....	2,379
Victoria.....	1 .....	100
TOTALS	<hr/> 56	<hr/> 27,377

March, 1901.  
WASHINGTON, D. C.

## AUSTRIA.

### CENTRALVEREIN FÜR RÜBENZUCKER INDUSTRIE IN DER OESTER- REICHISCH-UNGARISCHEN MONARCHIE.

Founded in 1854 at Vienna. In 1900: President, August Freiherr von Stummer; members, 213; associates, 49

*Publications* Organ des Vereins für R.-I., 1863-1874; Organ des Centralvereins für R.-I., 1875-1887, Oesterreichisch-ungarische Zeitschrift für Zucker-Industrie und Landwirthschaft, 1888-1900 (Beilagen) Der Marktbericht, 1874-1885, Wochenschrift des Centralvereins für Rübenzucker in der oesterreichisch-ungarischen Monarchie, 1886-1900

NOTE.—The Society maintains a Chemical Experiment Station under the direction of F. Stohmer.

### VEREIN ZUR HEBUNG DER ZUCKERFABRIKATION IM KÖNIGREICH BÖHMEN. [Also with a Bohemian name.]

Founded in 1868 at Prag under the presidency of Ferdinand Urbánek; the languages used were Bohemian and German. It was disbanded in 1874.

*Publication*: Zeitschrift für Zucker-Industrie. Organ des Vereins. Prag. 3 vols., 1872-74.

NOTE.—This journal is not to be confounded with: Zeitschrift für Zucker-Industrie in Böhmen, established at Prag in 1877 and current

### CHEMICKÁ SPOLEČNOST: SPOLEK ČESKÝCH CHEMIKŮ. [Chemical Society: Union of Bohemian Chemists.]

Founded in 1872 at Prag. In 1900: President, K. Preis; honorary members, 41; active members, 318; correspondents, 77.

*Publications*: Zprávy spolku českých chemiků. 2 vols., 1872-76. (Reports) Listy Chemické, 1877-1900. (Letters)

NOTE.—The Society has also published a Chemická Knihovna (Chemical Library) in 8 vols.

### ZEMSKY SPOLEK PRO PRŮMYSL CUKROVARNICKÝ V ČECHÁCH; VEREIN DER ZUCKERINDUSTRIE IM KÖNIGREICH BÖHMEN

Founded in 1876 at Prag. In 1900: President, Gustav Hodek; members, 325.

*Publications:* Zeitschrift für Zucker-Industrie in Böhmen, 1877–1900. (Beilage): Prager Zuckermarkt, 1881–1900.

#### OESTERREICHISCHE GESELLSCHAFT ZUR FÖRDERUNG DER CHEMISCHEN INDUSTRIE.

Founded in 1878 at Prag. In 1900: President, Georg Zetter; honorary members, 3; members, 196.

*Publications:* Bericht der oesterreichischen Gesellschaft zur Förderung der chemischen Industrie, 1879–98. Since 1899 the organ of the Society is: Oesterreichische Chemiker-Zeitung.

#### SPOLEČNOST PRO PRŮMYSL CHEMICKÝ. [Society of Chemical Industry.]

Founded in 1892 at Prag. In 1900: President, J. B. Lambl; honorary members, 20; active members, 440; correspondents, 54; founders, 57.

*Publications:* The organ of the Society since 1892 is: Časopis pro průmysl chemický, of Prag, which had been established in 1891. The Society has also published three volumes of a technological library: Knihovna technologicko chemická.

#### WIENER VEREIN ZUR FÖRDERUNG DES PHYSIKALISCHEN UND CHEMISCHEN UNTERRICHTS.

Founded in 1895 at Vienna. In 1900: President, Victor von Lang; members, 317.

*Publication:* Vierteljahrsberichte der Wiener Verein zur Förderung des physikalischen und chemischen Unterrichts, 1895–1900.

#### VEREIN OESTERREICHISCHER CHEMIKER IN WIEN.

Founded in 1897 at Vienna. In 1900: President, J. Klaudy; members, 878; founders, 14.

*Publication:* Oesterreichische Chemiker Zeitung, 1898–1900.

### BELGIUM.

#### ASSOCIATION BELGE DES CHIMISTES.

Founded August 4, 1887, at Brussels. In 1900: President, L. L. de Koninck; honorary members, 4; active members, 482; associates, 21; correspondents, 8.

*Publication:* Bulletin de l'Association Belge des Chimistes, 1887–1900.

NOTE.—The Association has 8 sections, viz: Liège, Louvain, Gembloux, Charleroi, Mons, Gans, Antwerp, Brussels.



**SOCIÉTÉ TECHNIQUE ET CHIMIQUE DE SUCRERIE DE BELGIQUE.**

Founded February 26, 1896, at Brussels. In 1900: President, Eugène Meeus; members, 173; patron, 1.

*Publications:* La sucrerie Belge, which was established August 31, 1872, has been the organ of the Society since its foundation. The Society has also published several pamphlets on technical topics.

NOTE.—The formation of Sections was under discussion in 1900.

**SYNDICAT DES CHIMISTES PUBLICS DE BELGIQUE.**

Founded in 1897 at Brussels. In 1900: President, François Sachs; members, 51.

*Publication:* Bulletin du Syndicat des chimistes publics de Belgique, 1897–1900.

NOTE.—The Society has in preparation: Recueil générale des méthodes d'analyse usitée dans les laboratoires publics.

SOCIÉTÉ GÉNÉRALE DES FABRICANTS DE SUCRE DE BELGIQUE is not a chemical society; its organ is: La sucrerie Belge, 1872–1900.

**FRANCE.****SOCIÉTÉ INDUSTRIELLE DE MULHOUSE.**

Founded in December, 1825, at Mulhouse (first meeting, May 11, 1826). In 1900: President, Auguste Dollfus; honorary members, 9; resident members, 190; non-resident members, 378; correspondents, 54.

*Publication:* Bulletin de la Société industrielle de Mulhausen (*sic*), 1827–1900.

NOTE.—This is not purely a chemical society, but it has a Committee on chemistry, and its Bulletin contains many papers on applied chemistry.

**SOCIÉTÉ CHIMIQUE DE PARIS.**

Founded June 4, 1857, at Paris. In 1900: President, Edouard Grimaux; members, 365; patrons, 121; life members, 91; corresponding members, 449.

*Publications:* (a) Bulletin des séances de la Société chimique de Paris, 1858–62; (b) Répertoire de chimie pure et appliquée, 1858–63; (c) Bulletin de la Société chimique de Paris, 1864–1900; (d) Conférences et Leçons, 5 vols.

## ASSOCIATION DES ÉLÈVES DE M. FREMY.

Founded in 1878 at Paris. In 1900: President, Louis Barthélemy; members, 200.

*Publication:* Bulletin trimestriel de l'Association des élèves de M. Fremy, 1878-1900.

NOTE.—A social organization which, however, publishes the work of its members.

## ASSOCIATION DES CHIMISTES DE SUCRERIE ET DE DISTILLERIE DE FRANCE ET DES COLONIES.

Founded in 1883 at Paris. In 1900: President, M. Durin; honorary members, 3; resident members, 160; non-resident members, 710; corresponding members, 395.

*Publication:* Bulletin de l'Association des chimistes de sucrerie et de distillerie de France et des Colonies, 1883-1900.

## ASSOCIATION AMICALE DES ANCIENS ÉLÈVES DE L'ÉCOLE DE PHYSIQUE ET DE CHIMIE INDUSTRIELLE DE LA VILLE DE PARIS.

Founded in 1885 at Paris. In 1900: President, Octave Boudouard; honorary members, 41; members, 300.

*Publication:* Bulletin mensuel de l'Association amicale des anciens élèves de l'École de physique et de chimie industrielle de la ville de Paris, 1885-1900. Annuaire [etc.], 1885-1900.

## ASSOCIATION AMICALE DES ANCIENS ÉLÈVES DE L'ÉCOLE DE CHIMIE INDUSTRIELLE DE L'LYON.

Founded in 1886 at the Institut chimique de Lyon. In 1900: President, Alphonse Seyewitz; honorary members, 6; members, 104.

*Publication:* Bulletin des séances de l'Association amicale des anciens élèves de l'École de chimie industrielle de Lyon.

## SYNDICAT CENTRAL DES CHIMISTES ET ESSAYEURS DE FRANCE.

Founded in 1890 at Paris. In 1900: President, Ferdinand Jean; members, 125.

*Publications:* Revue de chimie analytique appliquée à l'industrie, 1893-98. Annales de chimie analytique appliquée à l'industrie became the organ of the Society in 1899; the Annales had been established in 1896, and was united with the Revue (above named) in 1900.

## SOCIÉTÉ CHIMIQUE DU NORD DE LA FRANCE.

Founded at Lille in 1891. In 1900: President, A. Pouriez; members, 100.

*Publication:* Bulletin mensuel de la Société chimique du Nord de la France, 1891-1900

## ASSOCIATION AMICALE DES ANCIENS ÉLÈVES DE L'INSTITUT CHIMIQUE DE NANCY.

Founded November 9, 1892, at Nancy. In 1900: President, M. Noel; honorary members, 8; patrons, 7; members, 52; associates, 75.

*Publication:* Bulletin (annuel) de l'Association.

## ASSOCIATION AMICALE DES ÉLÈVES ET ANCIENS ÉLÈVES DU LABORATOIRE D'ENSEIGNEMENT PRATIQUE APPLIQUÉE DE L'UNIVERSITÉ DE PARIS.

Founded in 1897 at Paris. In 1900: President, M. Loyer; honorary members, 12; members, 110.

*Publication:* Gazette de chimie, Paris, 1900.

## GERMANY.

## VEREIN FÜR DIE RÜBENZUCKER INDUSTRIE IM ZOLLVEREIN [later, DES DEUTSCHEN REICHS; later, VEREIN DER DEUTSCHEN ZUCKERINDUSTRIE].

Founded in 1850 at Berlin. In 1900: President, De Coste; members, 447.

*Publication:* Zeitschrift des Vereins [etc.], 1850-1900.

## DEUTSCHE CHEMISCHE GESELLSCHAFT ZU BERLIN.

Founded in 1867 at Berlin. In 1900: President, G. Volhard; honorary members, 15; life members, 92; members, 2637; associates, 372.

*Publication:* Berichte der deutschen chemischen Gesellschaft zu Berlin, 1868-1900. Since 1897 also: Chemisches Centralblatt (established in 1830).

## VEREIN ANALYTISCHER CHEMIKER.

Founded in 1878 at Magdeburg, and merged in 1887 with the Deutsche Gesellschaft für angewandte Chemie. See Verein deutscher Chemiker.

*Publication:* Correspondenzblatt des Vereines analytischer Chemiker, 1878-80.

# FREIE VEREINIGUNG BAYERISCHER VERTRETER DER ANGEWANDTEN CHEMIE.

Founded in May, 1883, at Munich. In 1900: President, Albert Hilger; honorary members, 2; members, 124; correspondents, 69.

*Publications:* Bericht über die 1 [- 18] Versammlung der freien Vereinigung bayerischer Vertreter der angewandten Chemie, 1883-1900. Also reports in: Forschungsberichte über Lebensmittel und ihre Beziehung zur Hygiene, 1894-97; and in: Zeitschrift für Untersuchung der Nahrungs- und Genuss-Mittel, 1898-1900.

## VEREIN DEUTSCHER BERUFS-CHEMIKER.

Founded in 1887 at Dresden.

*Publication:* The "Chemiker und Droguist" (Dresden, 1885) had in 1887 the sub-title: Correspondenzblatt des Vereines deutscher Berufs Chemiker. This title was dropped in 1888.

## DEUTSCHE GESELLSCHAFT FÜR ANGEWANDTE CHEMIE.

Founded November, 1887, at Berlin, absorbing the Verein analytischer Chemiker. In 1896 the Society became: Verein deutscher Chemiker, *q. v.*

*Publication:* Zeitschrift für angewandte Chemie, 1888-1900. This was begun as: Zeitschrift für die chemische Industrie in 1887.

## VEREINIGUNG ÖFFENTLICHER ANALYTISCHER CHEMIKER SACHSENS.

Founded in 1890 at Plauen in Vogtland. In 1900: President, Arthur Forster; members, about 25.

*Publication:* Zeitschrift für öffentliche Chemie, 1897-1900. Also: Bericht über die Hauptversammlung des Vereines öffentlicher analytischer Chemiker Sachsens.

## VEREIN AKADEMISCH-GEBILDETE [later, DEUTSCHER] ZUCKERTECH- NIKER.

Founded in 1891 at Berlin. In 1900: President, H. Claassen; honorary members, 1; members, 406; correspondents, 3.

*Publication:* Zeitschrift des Vereins akademisch-gebildete Zuckertechniker, 1891-92.

NOTE.—The organ of publication changed several times.

## VERBAND DES LABORATORIUMS-VORSTÄNDE VON DEUTSCHEN HOCH- SCHULEN.

Founded in 1898 [?].

**ZWEIGVEREIN DER ZUCKERTECHNIKER FÜR DAS AUSLAND.**

Founded at Berlin. In 1901: President, C. Huck.

**DEUTSCHE ELEKTROCHEMISCHE GESELLSCHAFT.**

Founded in October, 1894, at Berlin. In 1900: President, J. H. van't Hoff; members, about 700.

*Publication:* Bericht der deutschen elektrochemischen Gesellschaft, 1894-1900.

**VEREIN DEUTSCHER CHEMIKER.**

Founded in 1896 at Berlin, as successor to Gesellschaft für angewandte Chemie (1887). Its seat is the residence of the President for a given year. In 1900: President, H. Caro; honorary members, 4; members, 2271. Embraced in 1900 the following sections (Bezirk-Vereine): Aachen, Belgien, Berlin, Frankfurt, Hamburg, Hannover, Mittel-Franken, Mittel- und Niederschlesien, Oberrhein, Oberschlesien, Pommern, Rheinland, Rheinland-Westphalen, Saar, Sachsen-Anhalt, Sachsen-Thüringen, Württemberg.

*Publication:* Zeitschrift für angewandte Chemie, 1887-1900. Cf. Deutsche Gesellschaft für angewandte Chemie.

**VERBAND SELBSTÄNDIGER ÖFFENTLICHER CHEMIKER DEUTSCHLANDS.**

Founded May 30, 1896, at Nürnberg. In 1900: President, Robert Kayser; members, 161; associates, 102.

*Publication:* Zeitschrift für öffentliche Chemie (established in 1895), 1897-1900. Also Vol. I. as Vol. III., 1897, of Centralblatt für Nahrungs- und Genussmittel Chemie, sowie Hygiene.

**GREAT BRITAIN.****SOCIETY FOR PHILOSOPHICAL EXPERIMENTS.**

Founded in 1794 at London.

*Publication:* Minutes of the Society for Philosophical Experiments, 1794.

NOTE.—A German translation of the *Minutes* was edited by Alex. Nic. Scherer and published at Halle in 1803.

**CHEMICAL SECTION OF THE BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.**

Founded in 1831. This is, however, a corporate part of the British Association, and the papers read to the Section are published in the annual Reports of the British Association, 1831-1900. In 1900: President, W. H. Perkin, jun.; number of members not given.

## CHEMICAL SOCIETY OF LONDON.

Founded in 1841 at London. In 1900: President, T. E. Thorpe; honorary and foreign members, 33; members, 2300.

*Publications:* Memoirs and Proceedings of the Chemical Society of London (1841-48); Quarterly Journal, 1849-62; Journal of the Chemical Society, 1863-1900.

## SOCIETY OF PUBLIC ANALYSTS.

Founded in 1874 at London. In 1900: President, Walter W. Fisher; honorary members, 9; members, 260.

*Publication:* Proceedings of the Society of Public Analysts, 1876; The Analyst, 1877-1900.

## INSTITUTE OF CHEMISTRY OF GREAT BRITAIN AND IRELAND.

Founded October, 1877, in London; incorporated, 1885. In 1900: President, John Miller Thomson; members, fellows, and associates, 1008 (resident members, 904); students, 118. Total, 1126.

*Publications:* Proceedings, half yearly, 1878-1900; Register, yearly, 1878-1900; Regulations, yearly, 1878-1900.

## SOCIETY OF CHEMICAL INDUSTRY.

Founded in 1881 at London. In 1900: President, Charles F. Chandler; honorary member, 1 (John Glover); members, 3459.

*Publication:* Journal of the Society of Chemical Industry, 1882-1900.

NOTE.—The Society has eight sections: London, Liverpool, Manchester, Newcastle, New York, Nottingham, Scotland, and Yorkshire.

## SOCIETY OF DYERS AND COLOURISTS.

Founded in 1884 at Bradford. In 1900: President, H. Grandage; honorary members, 3; members, 553.

*Publication:* Journal of the Society of Dyers and Colourists, 1884-1900.

## ALEMBIC CLUB.

Founded in 1889 at Edinburgh. This is a private club of only six members and has no president; the Secretary is Leonard Dobbin.

Publishes no journal, but has issued 15 Reprints of Chemical Monographs, etc., 1893-1900, and other works.

## INTERNATIONAL ASSOCIATION OF LEATHER-TRADES CHEMISTS.

Founded September, 1897, at London. In 1900: President H. R. Proctor; number of members, —.

*Publication:* Report of the Proceedings of the Conference of Leather-Trades Chemists, 1897.

## ITALY.

## ASSOCIAZIONE CHIMICO-FARMACEUTICA FIORENTINA.

Founded in 1877 at Florence. In 1900: honorary members, 20; resident members, 100.

*Publication:* L'Orosi, Bollettino di chimica, farmacia e scienze affini. Firenze, 1878–1900.

## SOCIETÀ CHIMICA DI MILANO.

Founded in February, 1895, at Milan. In 1900: President, Angelo Menozzi; resident members, 152; correspondents, 133.

*Publication:* Annuario della Società chimica di Milano, 1896–1900.

## ASSOCIAZIONE CHIMICO-INDUSTRIALE DI TORINO.

Founded June 25, 1899, at Turin. In 1900: President, Vittorio Sclopis; honorary members, 4; resident members, 103; correspondents, 87.

*Publication:* La Chimica industriale, 1899–1900.

## SOCIETÀ ITALIANA DEI CHIMICI ANALISTI.

Founded in 1893 at Pavia.

*Publication:* Atti ufficiale delle Società italiana dei chimici analisti, 1893. This forms a pamphlet of 18 pp. only, and is perhaps a mere prospectus, as the Society ceased to exist before 1900.

## JAPAN.

## CHEMICAL SOCIETY OF TOKYO.

Founded April, 1878, at Tokyo. In 1900: President, Naokichi Matsui; number of members, 156; associates, 197.

*Publication:* Tokyo Kagakkai Kaishi, 1880–1900.



## SOCIETY OF CHEMICAL INDUSTRY OF JAPAN.

Founded February, 1898, at Tokyo. In 1900: President, Takeaki Enomoto; honorary members, 7; members, 223; associates, 429.

*Publication:* Kōgyō Kagaku Zasshi, 1898-1900.

## RUSSIA.

## RUSSKAGO KHMICHESKAGO OBSHTCHESTVA [Russian Chemical Society].

Founded October 26, 1868. The Chairman of the first meeting was D. Mendeléeff. In 1900: President, F. F. Petrushevsky; members, 327.

*Publications:* Zhurnal Russkago Khimicheskago Obshtchestva. St. Petersburg, 1869-72, 4 vols.

*Continued as:*

Zhurnal Russkago Khimicheskago Obshtchestva i Fisicheskago Obshtchestva, 1873-78. 6 vols.

*Continued as:*

Zhurnal Russkago Fisiko-Khimicheskago Obshtchestva, 1879-1900.

## SOUTH AFRICA.

## CHEMICAL AND METALLURGICAL SOCIETY OF SOUTH AFRICA.

Founded May, 1894, at Johannesburg.

*Publication:* Proceedings of the Chemical and Metallurgical Society of South Africa, 1894-1897.

## SWITZERLAND.

## SOCIÉTÉ CHIMIQUE DE GENÈVE.

Founded February 10, 1878, at Geneva. In 1900: President, F. Kehrmann.

*Publication:* The Minutes of the monthly meetings are published in: Archives des sciences physiques et naturelles de Genève, and in the Chemiker Zeitung.

## VEREIN SCHWEIZERISCHER ANALYTISCHER CHEMIKER.

Founded March 12, 1887, at Zürich. In 1900: President, A. Bertschinger; number of members, 94.

*Publication:* The organ of the Society is Schweizerische Wochenschrift für Chemie und Pharmacie, which was established under the title, Schweizerische Zeitschrift für Pharmacie, 1856-62.

## UNITED STATES OF AMERICA.

## CHEMICAL SOCIETY OF PHILADELPHIA.

Founded in 1792 at Philadelphia, under the presidency of James Woodhouse. Number of members unknown. The Society was in existence for more than ten years.

*Publication:* Memoir on the Supply and Application of the Blowpipe [etc.] by Robert Hare, 1802.

## COLUMBIAN CHEMICAL SOCIETY OF PHILADELPHIA.

Founded August, 1811, at Philadelphia, under the presidency of James Cutbush. Honorary members, 69; junior members, 13.

*Publication:* Memoirs of the Columbian Chemical Society of Philadelphia. Vol. I., 1813.

## CHEMICAL SECTION OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

A migratory organization, founded in 1875 as a Sub-Section; it became Section C of the A. A. A. 'S. in 1882 at the second meeting in Montreal. In 1900: Chairman of the Section, Jas. Lewis Howe; members, 89; fellows, 181.

*Publications:* The Proceedings of the A. A. A. S. has a division containing papers read before the Section of Chemistry.

## AMERICAN CHEMICAL SOCIETY.

Founded April 20, 1876, in New York City. In 1900: President, William McMurtrie; honorary members, 10; members, 1546; associates, 123.

*Publications:* Proceedings of the American Chemical Society, 1877-78; Journal of the American Chemical Society, 1879-1900.

Note.—In 1900 the Society had 12 sections: Rhode Island, Cincinnati, New York, Washington, Lehigh Valley, Chicago, Nebraska, North Carolina, Columbus, North Eastern, Philadelphia, and Michigan.

## ASSOCIATION OF OFFICIAL AGRICULTURAL CHEMISTS.

Founded September 8, 1884, at Philadelphia. In 1900: President, B. W. Kilgore; members, 350.

*Publications:* Methods of Analyses, 1884-88; Proceedings, 1889-1900.

NOTE.—Conventions of the Official Agricultural Chemists had been held prior to 1884; in 1880 at Washington and Boston; in 1881 at Cincinnati; and in May, 1884, at Atlanta.

## CHEMICAL SOCIETY OF WASHINGTON.

Founded at Washington in 1884. In 1893 became the Washington Section of the American Chemical Society, retaining also its name as above. In 1900: President, H. Carrington Bolton; members, 114.

*Publication:* Bulletin of the Chemical Society of Washington, 1884-92.

## NEW ENGLAND ASSOCIATION OF CHEMISTRY TEACHERS.

Founded February 19, 1898. Meetings are held in New England. In 1900: President, Rufus P. Williams; honorary members, 8; active members, 50; associates, 22.

*Publications:* Circulars of Information and Reports, 1898-1900. Also Registers.

## VICTORIA.

## SOCIETY OF CHEMICAL INDUSTRY OF VICTORIA.

Founded in 1900 under the Presidency of Orme Masson; membership, about 100.

## ADDENDUM.

## SOCIÉTÉ D'ARCUEIL.

Founded in 1807 at Arcueil. Dissolved in 1822. Members (at any one time), 12.

*Publication:* Mémoires de physique et de chimie. Paris, 3 vols., 8vo. 1807-17.

NOTE.—This private organization was founded by C. L. Berthollet; the meetings were held at his country house in Arcueil, near Paris. The membership included: La Place, C. L. Berthollet and his son A. B. Berthollet, Biot, Gay Lussac, Humboldt, Thénard, Decandolle, Collet-Descotils, Berard, Chaptal, Dulong, Poisson, Malus.

The foregoing list does not include Academies of science nor Associations of general science (with a few exceptions); it does not embrace societies having for their object industries involving chemical processes in part, excepting the refining of sugar; nor does it include the numerous societies of brewers and of beer-making, among which may be named the following:

BRAU-INDUSTRIE VEREIN IM KÖNIGREICH BÖHMEN, founded at Prague in 1874, and publishing the Böhmisches Bierbrauer.

DEUTSCHE BRAUERBUND, founded at Nürnberg in 1861, and publishing the Allgemeine Hopfen-Zeitung.

WÜRTTEMBERGISCHE BRAUERBUND, founded at Waldsee in 1872, and publishing the Schwäbische Bierbrauer.

BADISCHE BRAUERBUND, founded at Nürnberg in 1876, and publishing the Hopfenlaube.

DEUTSCHE BRAUMEISTER VEREIN, founded at Berlin, 1887, and publishing the Deutsche Brau-Industrie.

ASSOCIATION GÉNÉRALE DES BRASSEURS BELGES, founded at Brussels in 1874, and publishing Revue des Bieres.

COUNTY BREWERS' SOCIETY, England, publishing since 1871 the Brewers' Guardian.















